Regional Planning for a Hill Area

A Case Study of Pauri Tehsil in Pauri Garhwal District

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(The views expressed and the recommendations made herein are those of the NICD and do not represent those of the Rural Electrification Corporation.)

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FOREWORD

During the past few decades, several programmes have been initiated for development of the hill areas in the country. The extreme backwardness of these areas is mainly due to past neglect compounded by difficult terrain, inaccessibility, soil erosion and shortage of agricultural land Programmes for development of the untapped potential of these areas in horticulture, forestry, sericulture, animal and sheep husbandry, village crafts and cottage industry have been recently initiated. It is obvious that a solution of the existing problems of these areas will have to be closely interlinked with the development and use of their natural resources. The primary requirement for such development is an adequate infrastructure of communication network, power supply, distribution of credit and other inputs, marketing and storage facilities. In addition, drinking water, and health and educational facilities will also have to be provided for.

The interlinkages of such activities are well recognized and various agencies of government, the Planning Commission in particular, have recommended integrated planning for development of these areas.

The present study, which was done in 1974, is a contribution to this thinking and presents an integrated rural development plan for a tehsil in the district of Pauri Garhwal in Uttar Pradesh.

The objectives of this study are two-fold. Firstly, an appropriate planning methodology suitable for hill areas has been developed. Secondly, substantive plan recommendations for a specific hill area which can be implemented in the near future, have been made.

It is my sincere hope that planners and administrators concerned with the development of hill areas will find the study useful.

NICD,
Hyderabad.

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Dean

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The field team which collected data in Pauri during the first half of 1973 consisted of Sarvashri Anand Hanmantgad, B.K. Thapliyal, S.C. Sethi and K.S. Singh. The tabulation of the data was also done by them along with Sarvashri R. Jagannadha Rao, A.V.K. Sharma, T. Lakshmaiah, V. Srinivasulu Reddy, J.B. Ramkumar, S. Subba Reddy, D.V. Ramana and M.J. Mohan Rao. The cartographic work was done by Sarvashri D Jayanandam, S. Ch. Subba Rao, A. Lakshmaiah and Syed Meer Hussain.

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THE AUTHORS

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CHAPTER I

INTRODUCTION

The study reported in the following pages was undertaken along with two other studies of similar nature at the request of the Rural Electrification Corporation (REC). The first of these studies published under the title *Regional Planning for Rural Electrification : A Case Study in Suryapet Taluk*, was undertaken in a semi-arid taluk of Nalgonda district in Andhra Pradesh. The present study of a tehsil in Pauri-Garhwal district in Uttar Pradesh is the second in the series. The third study entitled *Regional Planning for an Arid Zone : Case Study of a Taluk in Jodhpur District, Rajasthan,* is under preparation. The areas were selected for their extreme backwardness and also for their different agro-climatic and topographical characteristics.

The purpose of these studies was to examine the extent to which electricity can contribute to the development of backward areas with different agro-climatic and topographical characteristics. The conventional practice of the State Electricity Boards in the past was to provide transmission lines in the rural areas purely on a commercial basis. Thus the chances of prosperous areas to receive power was better than backward areas where the commercial viability of electrification was low in a short-term sense. The REC, as the main funding agency for rural electrification in the country, has introduced a system of long-term loans at staggered rates of interest with the purpose of using electricity as a catalytic agent for developing backward areas. This is a welcome departure from the earlier practice of providing electricity to areas which are already advanced and commercially more viable. The REC, however, is a commercial organization and must recover the loans advanced by it with interest. At the same time, as an official organ, it is committed to the development of rural areas. These two seemingly conflicting interests have been resolved in the policy of long-term loans mentioned above. The assumption behind this policy is that a backward area will need time to develop and electricity will be supplied on that supposition. Eventually, the area will be able to pay back its dues and electricity will have played its constructive role in nation building.

This policy is, however, based on a few assumptions. First, the area must be carefully selected for its ability to develop and pay back the loans. Secondly, with the introduction of electricity, other development programmes must also be implemented simultaneously for an effective utilization of the power supplied. These other development programmes in the fields of agriculture, horticulture, animal husbandry, forestry, industries, water management and transportation will be in the hands of other agencies. Electricity can be introduced in an area unilaterally and the evolutionary result of such action can also be quite positive. The results may, however, take decades, a period too long for a commercial organization to accept.

Even if the selection of the area is correct and the various agencies are willing to cooperate in implementing their own programmes simultaneously, an added assurance is necessary that all these activities are really going to develop the area in the right direction. In other words, the development schemes of the various departments and agencies must be

tailored to fit the needs of a specific area and geared to an overall plan of which electrification will also form a part.

The need for an overall integrated plan for an area providing precise roles for the various agencies at precisely defined time-phases cannot be over-emphasized. If the selected area has the potentiality to develop and if the agencies implement their part of the total plan as and when required in a correct sequence, there is no reason why the area cannot be developed. Electricity, as one of the most basic inputs for development, will have to come very early in the implementation of the total plan as many other activities will depend on the availability of power.

How is this integrated plan to be formulated? One way is for the various agencies to put their heads together and prepare a co-ordinated plan for implementation. Each department or agency will have its own schemes and will have to align them with schemes formulated by other departments. However, schemes belonging to a particular department are sanctioned and funded not on the basis of the needs of a particular area but on the basis of national priorities and the nature of the schemes and the budget allotted for them may have to be uniformly applied all over the country regardless of the special needs of a particular area. Actually, our system of planning for the past 25 years has followed this method of sectoral allocations and schematic budgets.

Fortunately, an alternative method of planning has been mooted by the Planning Commission in recent years known variously as *Area Planning, Area Development Planning or Integrated Area Development Planning*. This method looks at the development of an area not from the point of view of agencies, but from the view point of the area itself. If the potentiality of an area is correctly assessed, then a few things need to be done on a time scale with critical inputs preceding non-critical but nevertheless important inputs. A scientific plan based on a thorough analysis of the potentiality of an area and its systematic development must precede any agency or departmental activities.

As we have noted earlier, sectoral planning does not provide answers for the implementation of specific programmes at the grass-roots level. Sectoral planning at the macro-level establishes national priorities by indicating through budgetary allocations, subjects which concern the nation at various levels of importance. The programmatic question of how to utilise these funds for the maximum multiplier effect needs a different approach, an approach which starts at the village but remains within the overall framework of national priorities and budgetary allocations. In some cases, this approach may even help in modifying national priorities by reflecting the correct state of affairs at the grass-roots level.

The concept which is most relevant for the above approach is integrated area development.

The concept of integrated area development in its true scientific meaning has gained currency only during the last few years. Very briefly, it refers to two types of integration—functional and spatial—which are themselves interrelated. Functional integration refers to the integration of all economic and social activities which influence the life of a people. Thus, health, education, agriculture, industries and several other aspects of our day-to-day living overlap. A change in one sector almost invariably brings about a change in another. This point is generally understood and needs no elaboration here. It is also understood that any policy for development must try to utilise these interrelationships. What puzzles admin-

istrators and social workers who are responsible for implementing policies is how to use this knowledge.

The community development programme in India tried to achieve functional integration by establishing an integrated staffing pattern. Specialists from different departments of government representing health, education, agriculture, industry, etc. were brought together as a team at the block level and it was expected that the daily interaction among such an interdisciplinary team will also lead to an integrated development of the rural areas. By and large, this has not happened.

There are many reasons for this failure which have been discussed at length in hundreds of publications and in public forums. For obvious reasons, we will not list them here. However, one of the reasons which has not been discussed often enough and which has never been fully understood is the spatial nature of functional integration. This brings us to a discussion of the second dimension of integrated area development.

The interrelationship among various socio-economic activities depend a great deal on where they are located. If spatial relationships among existing activities are observed, it will be noticed that there is a definite pattern in the dispersal or concentration of activities in space. The actual location of a specific function in relationship to other functions depends on several factors. Some of the important factors are the general level of development, demand for specific functions and their supply, accessibility of these functions in terms of roads and transportation, time and distance of travel, level of income of the people, cost of obtaining these functions, and so on. Large portions of our rural areas are deprived of many basic amenities of life due to one or a combination of such factors. On the other hand, there are areas where there is a concentration of such functions due, again, to similar reasons.

Thus, in the context of development when new activities of functions are proposed, the location of such functions becomes extremely important. An appropriate location of a new function may start a chain reaction of development with far-reaching effects. An understanding of functional interrelationships in space, therefore, goes a long way toward the development of an area. This is the idea behind the concept of integrated area development.

Integrated area development, thus, refers to the appropriate location of social and economic activities over a physical space for the balanced development of a region. The idea of an appropriate location is by definition selective. In other words, each and every settlement cannot have each and every function. It has been observed by location theorists that there is a hierarchy of settlements based on the number of functions of different orders and specialisation and also on the basis of the area served by a settlement. All functions of different orders, therefore, need to be located in the most appropriate places. It must be pointed out that this selective location is by no means discriminatory. Higher-order settlements have their own hinterlands which include those of the lower-order settlements. The location of a specific function in a specific settlement is meant not only for the centre but also for its dependent territory. The pattern of linkages between the centre and its territory may need strengthening but the appropriate location of functions will necessarily be in the central place itself.

The idea of selective and appropriate location is most relevant under our present economic conditions. We do not have enough resources to provide all services and all development programmes to all settlements. Furthermore, we need quick returns for all

our investments to build up our capital supply for further investments. Selectivity should, therefore, be our guiding principle in any future investment.

Integrated area development is also concerned with the development of backward areas. If the existing hierarchy of settlements in a particular region is utilised for formulating a development plan, then areas far away from the important centres of economic activity may remain permanently underdeveloped. Some inducement for growth is, therefore, necessary in backward areas in the form of overheads and infrastructures in selective locations. The nature of investment will, of course, depend on the potential resources of the backward area and on the expected multiplier effects of the investment. This, in effect, is the idea of decentralisation.

Integrated area development is, thus, based on the ideas of selectivity on the one hand and decentralisation on the other. Decentralisation of development is seen here on a regional level between the rich and the poor areas. But the actual location of developmental programmes in both the rich and the poor areas is selective.

The decentralisation and the actual location of functions need to be done within the framework of a region encompassing both urban and rural sectors. In the past, the development of these two sectors has been kept separate and the towns could not be utilised for the development of rural areas. It is needless to say that the separation of the urban from the rural is arbitrary and harmful from the point of view of development of a region.

The concept of integrated area development suggests a framework for decentralising economic and social activities by locating specific functions in appropriate places. The network thus created provides a meaningful infrastructure which can attract and sustain a diversified but a growing economy.

The present study has been devoted to the preparation of an integrated area development plan for Pauri tehsil in the district of Pauri-Garhwal in Uttar Pradesh. It examines the potentiality of this hill area in the fields of agriculture, horticulture, forestry, sericulture, animal husbandry and industries, and recommends programmes for the development of these sectors in an integrated fashion. During plan preparation, special emphasis has been given to water management, transportation and electricity, the three major deficiencies in the area. The main purpose of the study is, of course, to evaluate the need for electricity as a basic input and detailed recommendations have been made for its supply in the area, along with recommendations for the improvement in the water management and transportation systems.

The specific objectives of this study are :

1. (*a*) To assess the agricultural, horticultural and other similar potentialities of the area ;

   (*b*) to assess the irrigation possibilities for the purpose ;

   (*c*) to assess the amount of electricity which will be required for lifting groundwater, canal water, etc. for realization of this potentiality.

2. (*a*) To assess the need for other elements of infrastructure such as marketing, storage (including cold storage) and processing industries;

   (*b*) to assess the amount of electricity that will be needed to develop these.

3. (*a*) To assess the industrial potentiality of the area;
   (*b*) to assess the amount of electricity that will be needed for this purpose.

4. To assess the amount of electricity that will be needed for the development of new towns as growth centres where important socio-economic activities can be located.

CHAPTER II

DESIGN OF THE STUDY

Selection of the Study Area: Pauri Tehsil

The district of Pauri-Garhwal was initially chosen for this study as a typical hill area with untapped natural resources on the one hand and serious problems of soil erosion, inaccessibility and extreme economic backwardness of the people on the other. Although the geographical area of the district is about the same as any other district in the plains, its difficult topography, inaccessibility and a very large number of settlements made it impossible to cover the entire district in one study. There are two tehsils in the district, Pauri and Lansdowne and it was decided to select the smaller of the two, Pauri for our purpose. Although small in size, Pauri tehsil has 1,389 villages and three towns. A tehsil (or taluk) in the plains, roughly of the same geographical area, has an average number of only 150 villages. Thus in terms of the number of settlements, Pauri tehsil provided a large enough base for a study of this nature. The natural boundaries and absence of an adequate road net work isolated the tehsil from the neighbouring areas. Recommendations made in this report will certainly reduce the isolation of the tehsil, but as it stands today, it is a distinct unit which can be used as a base for area planning.

Planning Problems in a Hill Area

For planning purposes, hill areas constitute a distinct category where many of the conventional planning techniques do not apply. One of the major steps in regional planning is to identify central places of different orders and their hinterlands. Population sizes of settlements which provide an easy and valid measuring rod in the plains did not apply in Pauri and other criteria had to be used after a great deal of experimentation.

The location of central places in the study area depended on the following few factors : accessibility, availability of flat land and water, and exposure to Sun throughout the year. The last factor is a typical behavioural response of the people to the cold climate of the area.

In measuring people's movements, it was found that the straightline distance between two centres which is a scientifically valid approximation of the actual line of movement in the plains, does not hold true in the study area (and this should be true in all hill areas without an adequate transportation network). It was found that the actual line of movement follows the lowest gradient between two centres. The effective distance between two centres was actually much longer than a straight-line distance between them.

The hill areas in the country, except for a few resort areas, are invariably backward. The topography of the land makes any development effort extremely expensive. Most of these areas have, therefore, remained neglected for years and the vast natural resources of these areas have not been economically utilized for the benefit of the local people. On the contrary, due to the pressure on land and the cold climate, forests have been cruelly and unproductively used for grazing and for firewood causing one of the most serious problems of the area—soil erosion. Before any planning is done, some of these very basic and fundamental problems must be solved. This compels a planner to extend the planning period to

an uncomfortable length, a major part of which is used up in solving these problems. The return for the investments made for this purpose is slow in coming and the planner is hard-put to justify the investment.

Perhaps, the worst problem faced by a planner in an area like this is the near absence of basic information on soils, water, mineral deposits, land utilization, agricultural production, horticulture, livestock and forests. This deficiency ruled out any precise statistical analysis of the future potentiality of the area. Other methods, admittedly less refined, had to be used.

The total geographical area of a hill area is not the same as its actual land area available for development. The former is a two-dimensional index tabulated by the official statistical office. The official land use data are also based on this two-dimensional approach. In a plain area, this index provides an accurate measure of land use. In a hill area, on the other hand, only a three-dimensional approach can provide a realistic assessment of the situation. To resolve the discrepancy between official statistics and actual land use becomes a major methodological bottleneck.

Problems of this nature were faced at every step in the study area and very few conventional planning techniques were available to solve them. What has been reported in this study is the result of much experimentation by which some answers could be found. Out of a number of alternatives, methods which are scientifically valid and yet simple to use were used in the study and have been reported here.

Plan Period

It was decided to take a plan period of 10 years from 1974 to 1984, broken into two phases from 1974 to 1979 and from 1979 to 1984 for projections and recommendations. Where available data, both past, and present, are extremely limited, it is risky to use a very long plan period. However, the extreme backwardness of the area, the virgin state of development of its natural resources, the absence of an infrastructure and very serious problems of soil erosion, marginal and fragmented landholding and low fertility of the soil, called for a long period of investment. If all necessary data were available, the ideal plan period for an area of this type should have been 25 years or more. We have made a compromise at a 10-year period broken into two convenient 5-year periods with the expectation that evaluations will be made at the end of each 5-year period for revising and modifying the plan.

Data Collection from Primary and Secondary Sources

Data from both primary and secondary sources were collected during the first half of 1973.

Secondary Data

Secondary data were collected from various official sources in the state headquarters in Lucknow, in the district and tehsil headquarters in Pauri and in the six block headquarters. Information was sought on the following subjects : (1) provisional census data for 1971, (2) soils, (3) geological data, (4) agriculture, (5) horticulture, (6) forests, (7) sericulture, (8) animal husbandry, (9) irrigation, (10) extension services, (11) health and veterinary facilities, (12) cooperation, (13) roads, (14) markets, (15) transportation and communication, (16) banking and other credit facilities, (17) commercial establishments, (18) employment

and unemployment, (19) information on retired army personnel, (20) industries, (21) education, (22) postal facilities, (23) Five-year Plans and government schemes for the area, (24) data maintained by patwaris, (25) electricity, and (26) other relevant data.

Primary Data and Questionnaires

Sampling. The tehsil has three towns and 1,389 villages of which 1,207 are inhabited. Since it was impossible to cover such a large number of villages within our time limitations, it was decided to use a sample of villages for a primary survey. Because of the special nature of this study, the idea of random sampling was rejected. Instead, all villages above 300 population, all market centres, in addition to the three towns were selected for the survey. The average population size of a village in the tehsil is about 150 and a preliminary analysis of the available secondary data on the availability of functions indicated that villages with less than 300 population could be safely omitted from the sample. The average population of the market centres other than the three towns is extremely small. Trades people and their customers commute to these centres everyday from nearby villages but very few people actually live there. Because of the commercial importance of these centres they were also selected. In all, 181 settlements including 106 villages above 300 population, 72 market centres and three towns were covered by the primary survey.

The following questionnaires were canvassed : (1) town schedule, (2) village schedule, (3) market schedule, (4) industry schedule, (5) consumption schedule, and (6) electricity schedule. In addition, a traffic origin, destination and volume schedule was used at different census points on the main roads of the tehsil.

Analytical Design

1. The first logical step in the design was to identify basic planning units which are small enough for the impact of development to be felt but large enough to have an adequate population and resource base for investments. Central places at three levels were identified with the help of information on people's movements seeking functions and services of different orders. On an ascending scale, these central places at three levels were labelled as central villages, service centres and growth centres. Hinterlands of these centres were identified partly by the space preference data and partly by the application of model for retail gravitation modified to fit the topographical characteristics of the area.

The central villages and their hinterlands called *clusters* in this study were used for estimating local needs and for projecting population and agricultural production.

2. The potentialities of agriculture, horticulture, forestry, sericulture and animal husbandry were analyzed by examining the existing land use under these activities. Maps showing the basic properties of the land and the present land use pattern were superimposed on each other. The composite sieve map showed the potential areas which could be brought under agriculture, horticulture, forests, sericulture and grazing land.

3. Irrigation potentiality was examined by locating the many streams of the area on a map. Probable lift irrigation projects, wherever technically feasible, were marked on the map and the command area of each project was also identified. It was found that a large area could be brought under irrigation if the irrigation potential of the area is fully utilized.

4. Projections for the future agricultural, horticultural, sericultural, sylvicultural and animal-based products were made on the basis of the proposed increase in acreage under these activities, expected improvement in yield and increased irrigation.

5. The infrastructure required for these activities consisting of input distribution centres, extension agencies, markets and storage facilities were recommended in select locations and in central villages, service centres and growth centres.

6. Due to the absence of information on mineral deposits, recommendations were made only for industries based on agriculture, horticulture, forests, sericulture and animal husbandry. The number, capacity and the nature of these industries were related to the resource base and the expected volume of production. The actual locations of these industries were based on their relevance to the resource areas and also on the scale of the industry. Industries dependent on large hinterlands were proposed in service centres and growth centres only.

7. Recommendations for social facilities such as educational and health institutions, were also located in select places based on population projections (age-wise projections for schools) and the hierarchic status of the proposed centres.

8. The proposed transportation system in the tehsil has been recommended on the basis of an analysis of the existing volume and direction of passenger and goods traffic on the main roads. A traffic survey was conducted at eight census points with the help of a questionnaire. The poor utilization of the existing main roads observed during the survey was an index of the general economic backwardness of the area. New roads and a ropeway have been proposed to open up the resource areas of the tehsil and to link inaccessible villages to market centres and towns.

9. The last but not the least part of the analysis was devoted to an estimation of power requirements for the development of the taluk in the fields of agriculture, horticulture, forestry, sericulture, animal husbandry, industries and social facilities. The estimates were made on the basis of the various recommendations offered in this report on lift irrigation schemes, storage, marketing, industries, transportation, and social facilities. Requirements for street-lighting, domestic and non-domestic use were also assessed for the settlements proposed to be electrified.

The final calculation was done in the form of requirements for each irrigation project, and each village and town indicating the number of connections and connected load in kilowatts or horse-power.

CHAPTER III

THE STUDY AREA : PAURI TEHSIL

Pauri tehsil is a part of the district of Pauri-Garhwal in Uttar Pradesh. It lies between 29°55′ and 30°15′ north latitude and between 78°35′ and 79°10′ east longitude. The northern, western and southern boundaries of the tehsil are well defined by two rivers, Alaknanda and Nayar. While Alaknanda separates it from the district of Tehri-Garhwal in the north, river Nayar demarcates it from Lansdowne tehsil in the west and in the south. The administrative border between Chamoli and Garhwal districts forms the eastern boundary of the tehsil. (Fig. III.1).

The tehsil occupies an area of 2,211 square kilometers and according to the 1971 census, has a population of 2,03,215 persons. Only 7.40 per cent (15,020) of this population has been classified as urban and the remaining 92.60 per cent (1,88,195) as rural. There are 1,389 villages and three urban centres in the tehsil. The three urban centres are : Pauri which is also the tehsil and district headquarters, Srinagar and Bahbazar. Bahbazar is a part of the town of Devprayag which is located in Tehri-Garhwal district. Among the villages, 1,207 are inhabited and the remaining 182 are uninhabited. The distribution of inhabited villages by population groups is as follows. (Table III.1).

TABLE III. 1: DISTRIBUTION OF VILLAGES ACCORDING TO POPULATION SIZE GROUPS IN PAURI TEHSIL (1971)*

S.No.	Range of population	Number of villages
1.	Below 100	516
2.	100— 300	536
3.	300— 500	120
4.	500—1,000	33
5.	1,000—1,500	1
6.	Above 1,500	1
	Total inhabited villages :	1,207

It can be seen from Table III.1 that more than 40 per cent of the inhabited villages have less than 100 people. The average population size per village is only 153. This is far below the national average of 1,000 people per village. The average density of population per sq. kilometer is about 90. The rural density is about 84 per sq. kilometer.

Historical Background

Pauri-Garhwal was a part of the old Garhwal kingdom extending over Pauri-Garhwal, Chamoli-Garhwal, Uttarkashi and Dehradun districts. However, in the early nineteenth century, along with Chamoli and Dehradun districts, Pauri-Garhwal also came under the British rule. At present, the town of Pauri serves as the headquarters of the Garhwal division, Pauri-Garhwal district and also Pauri tehsil.

* The population figures are tabulated from the provisional figures of Census, 1971.

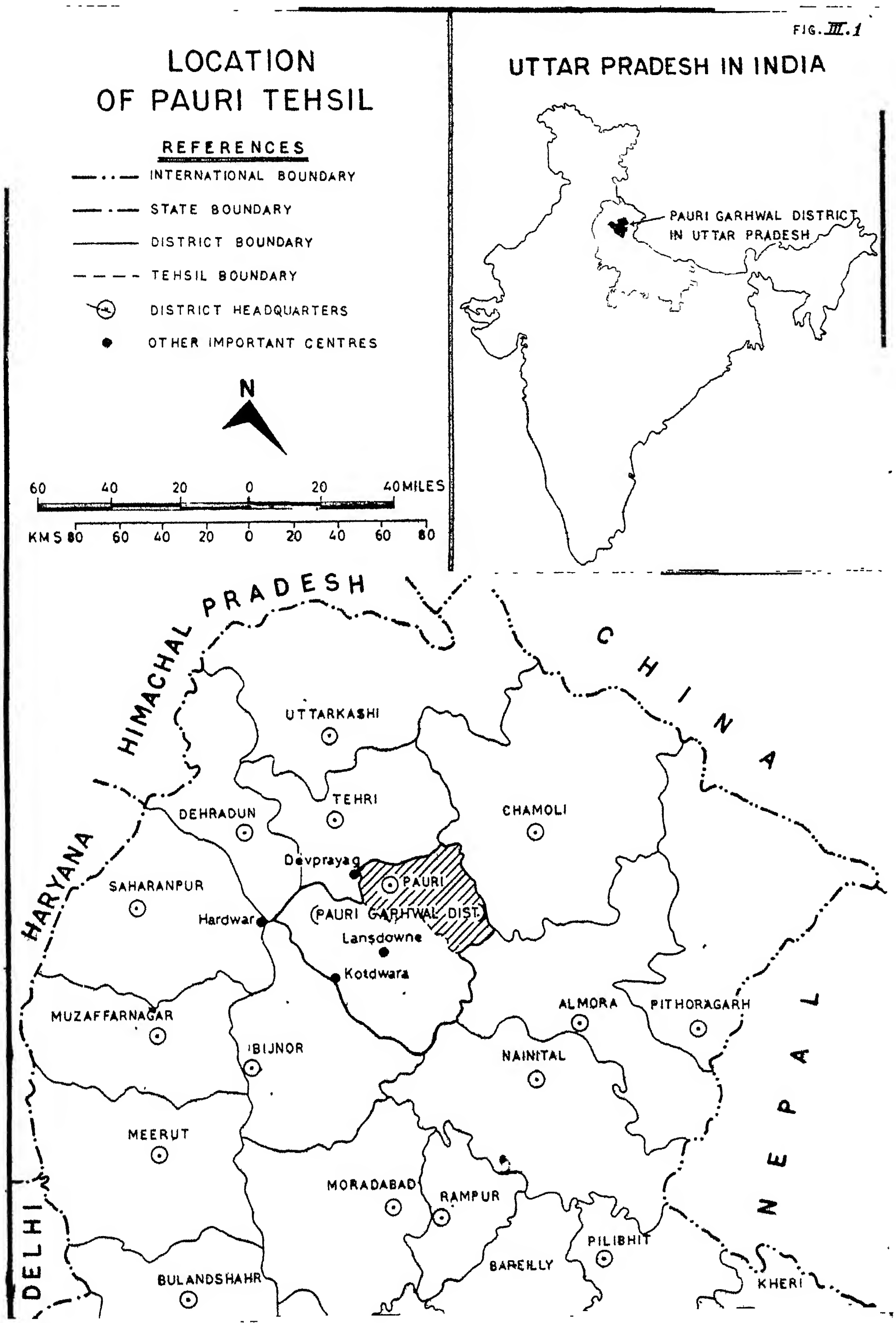


FIG. III.1
LOCATION
OF PAURI TEHSIL
REFERENCES
INTERNATIONAL BOUNDARY
STATE BOUNDARY
DISTRICT BOUNDARY
TEHSIL BOUNDARY
DISTRICT HEADQUARTERS
OTHER IMPORTANT CENTRES
N
60 40 20 0 20 40 MILES
KMS 80 60 40 20 0 20 40 60 80
UTTAR PRADESH IN INDIA
PAURI GARHWAL DISTRICT
IN UTTAR PRADESH
HIMACHAL PRADESH
CHINA
HARYANA
UTTARKASHI
TEHRI
DEHRADUN
CHAMOLI
Devprayag
PAURI
SAHARANPUR
Hardwar
(PAURI GARHWAL DIST.)
Lansdowne
Kotdwara
ALMORA
PITHORAGARH
MUZAFFARNAGAR
BIJNOR
NAINITAL
MEERUT
MORADABAD
RAMPUR
NEPAL
PILIBHIT
BAREILLY
DELHI
BULANDSHAHR
KHERI

Administration

The Garhwal division comprises four districts, namely, Pauri-Garhwal, Tehri-Garhwal, Chamoli and Uttarkashi. The division is under the administrative control of a Divisional Commissioner with headquarters at Pauri. Pauri tehsil is a part of the Pauri-Garhwal district. The district and the tehsil are administered by a Deputy Commissioner and a sub-Divisional Magistrate, respectively. At the district level, the Additional District Magistrate (Planning) coordinates the activities of the various development departments. In addition, an area development agency has been formed in 1973 and it is made responsible for executing various development programmes in the area.

For the efficient execution of the development programmes, the district is further divided into development blocks and each is under the administrative control of a Block Development Officer. These development blocks are supported by Kshetra Samitis (headed by Pramukhs) which function as advisory bodies for the development of the area. There are six blocks in Pauri tehsil, namely, Pauri, Pabau, Khirsu, Thailisain, Kaljikhal and Kot. Next in the hierarchy vested with the duties of development programmes are the gram panchayats. There are 372 such panchayats in Pauri tehsil. The lowest unit of administration is the village which is under the administration of a Patwari. To maintain law and order in the tehsil, two police stations are located at Pauri and at Shrinagar. In addition, there are two police outposts located at Devprayag and Rudraprayag.

Topography

The topography of the tehsil is characterised by rugged and mountainous terrain. The altitude varies from 600 metres to 2800 metres (Fig. III.2). The elevation of land increases from the north, west and south towards east and north-east. The mountainous tract is characterised by a succession of steep mountain ridges divided from each other by deep valleys and is subject to gulley erosion. The hills of the tehsil present gradual slopes at the base and end in a succession of narrow terraces and flats at the top. Excepting the river banks and ridges, there is very little flat land in the tehsil. The western half of the tehsil, as a result of the relatively more favourable topography, accounts for the maximum number of settlements and agricultural areas.

Drainage

The tehsil falls within the catchment area of three large rivers and their innumerable tributaries. The major rivers which need to be mentioned here are as follows:

River Alaknanda. Alaknanda river originates in the Himalayas and enters the tehsil at Ghottir in the north. It flows to south-west and after its confluence with Bhagirathi at Devprayag, forms the Ganga river. The river is snow-fed with a large catchment area and carries abundant water throughout the year. It is also used for transporting timber from the forest areas to the plains.

Eastern Nayar. Eastern Nayar rises from the Dudhatoli mountains and traverses through Thailisain block before entering Lansdowne tehsil.

Western Nayar. This also originates from Dudhatoli and flows through Thailisain, Pabau and Kaljikhal blocks. It joins the Eastern Nayar at Satpuli forming Nayar which drains into Ganga at Byasghat.

Besides these three major rivers, there are a large number of perennial streams which are well-distributed over the tehsil (Fig. III.3).

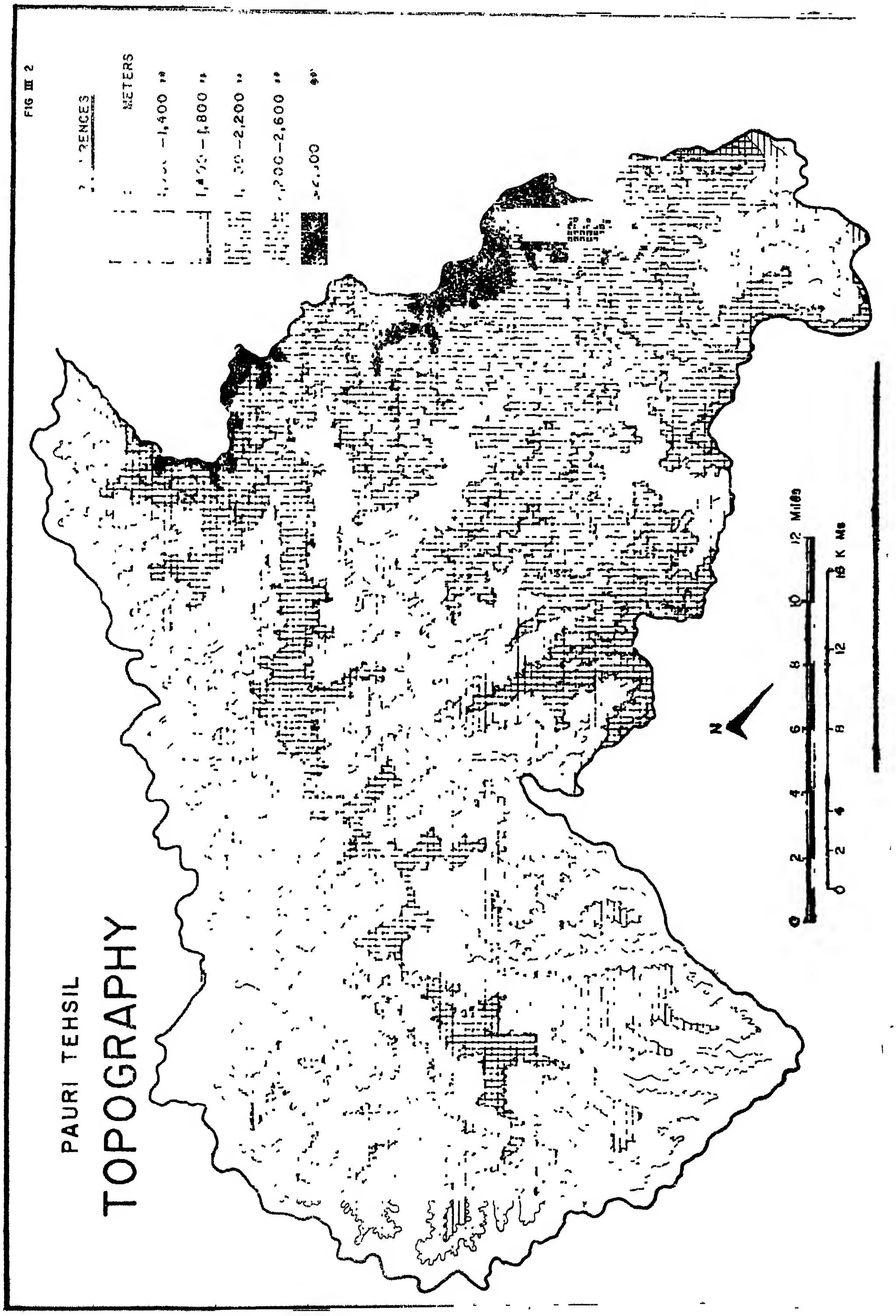
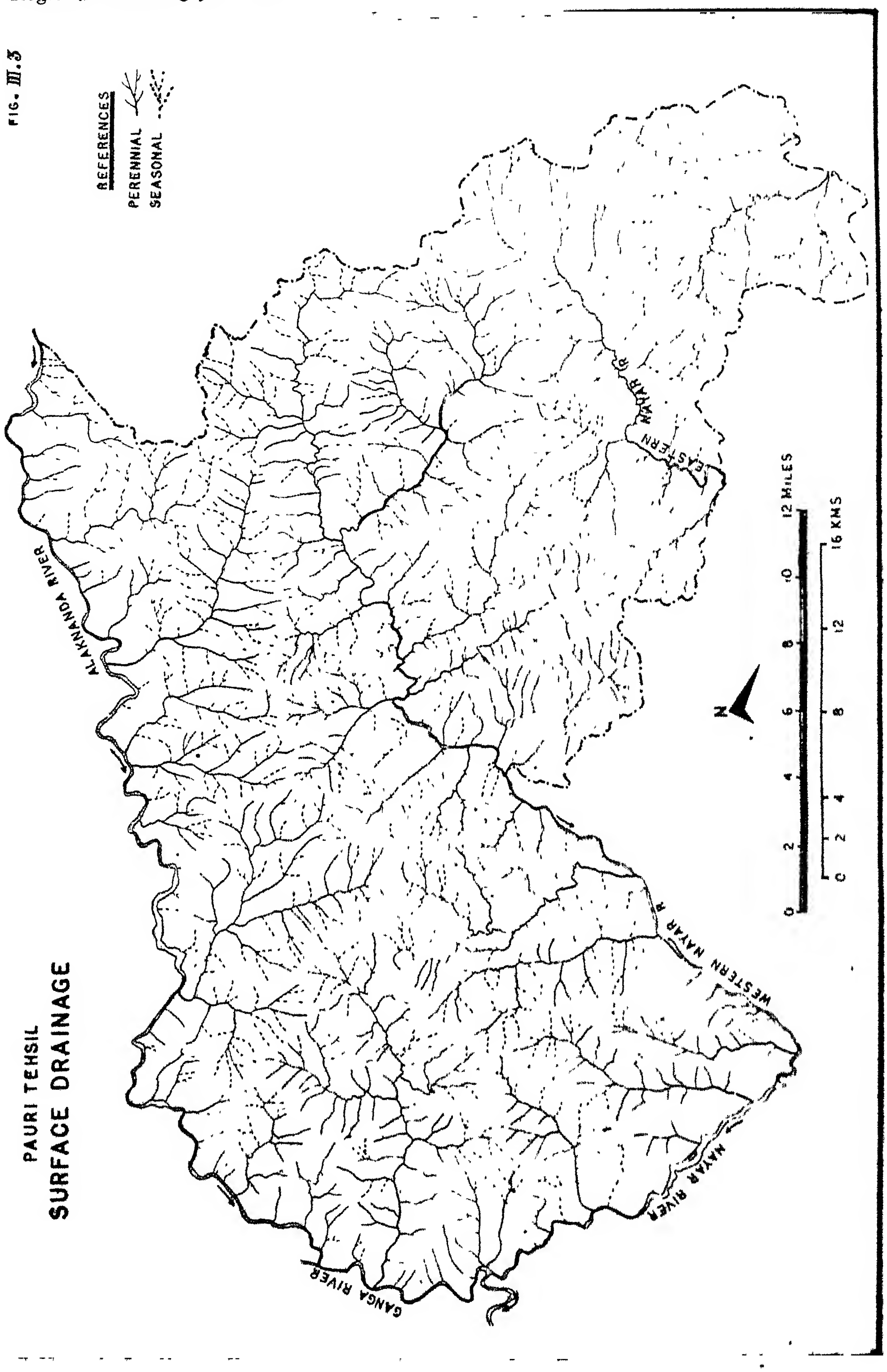

PAURI TEHSIL
TOPOGRAPHY
FIG III 2
METERS
12 Miles
N

FIG. III.3


PAURI TEHSIL
SURFACE DRAINAGE
REFERENCES
PERENNIAL
SEASONAL
ALAKNANDA RIVER
GANGA RIVER
NAYAR RIVER
WESTERN NAYAR R
EASTERN NAYAR R
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

Geology

The important geological formations of the tehsil are sandstone, limestone and metamorphic rocks. The Dudhatoli rocks are a conglomerate of flints and sand. In the southern part of the tehsil the rock formation is chiefly micaceous.

Minerals

Sufficient information regarding the mineral wealth of the tehsil is not available. From the preliminary studies of the Industries Department of the Government of Uttar Pradesh, it is known that limestone deposits are found along Alaknanda river. Iron and Copper ores are also said to be found in Dhanpurpatti in Khirsu block. Mica with tourmaline is widely spread over Dudhatoli.

Climate

Pauri tehsil falls within the temperate zone and the climate consists of a long and chilly winter and a short summer. The climate in the river valleys is unhealthy. Intense damp cold and mist in these areas are succeeded by considerable heat and humidity. In areas of high altitude, the temperature often falls below freezing point during winter and precipitates snow and frost. The average rainfall of the tehsil during the last decade (1951-61) was 1,538.6 mm. (60.7″). The variations in rainfall can be seen from the rainfall records of the last ten years. (Table III.2)

TABLE III.2 : RAINY DAYS AND RAINFALL DURING 1951-61 (PAURI TEHSIL)

Year	Total rainy days	Total rainfall	
		In mm.	In inches
1951	69	1536	60.6
1952	61	1209	47.6
1953	63	1392	55.0
1954	80	1735	68.5
1955	84	1602	63.2
1956	78	1732	68.2
1957	NA*	NA	NA
1958	NA	NA	NA
1959	NA	NA	NA
1960	64	1264	48.7
Average	71	1538.6	60 7

*NA : Data not available.

It can be seen from Table III.2 that the annual rainfall varied from 1,209 mm. (47.6″) in 1952 to 1,735 mm. (68.5″) in 1954. Similarly the number of rainy days also varied from 61 to 84 days and the average for the decade was 71 days. The maximum rainfall in a year was recorded in the month of August (415.6 mm) and the minimum in November (3.6 mm.).

Soils

Detailed and systematic information about soils in the tehsil is still not available. Since soil is one of the key factors determining the cropping pattern and agricultural input requirements, a scientific soil survey is essential for any future development in this area. Information is available only on the genetic classification of soils in this area which indicates that the soils in the tehsil vary widely depending on the formation of surface.* Four types of soils can be recognised in the tehsil. These are (1) red loams, (2) brown forest soil, (3) podsol, and (4) meadow soil (wiesenboden).

Red loams. Red loams are found along the steep slopes of hills and ridges. They are sandy in nature and are generally dry.

Brown forest soil. This soil is distributed all over the tehsil. Its fertility varies from medium to high. In most cases this soil is covered by forests.

Podsol. Podsol is generally found on mild slopes and shady places and is clayey in nature.

Meadow soil (wiesenboden). This soil is found near nullahs and streams. Owing to high ground-water level, this soil always remains moist and during winter a thick matting of frost covers it.

As a general rule, the soil on steep slopes is sandy in texture whereas in mild slopes it is clayey. The soil in the smaller valleys is usually very rich. It is composed of the soils washed down by water from the hill sides.

Demographic Characteristics

The total population of the tehsil according to the 1971 census count is 2,03,215 with 90,318 males and 1,12,897 females. The sex-ratio for the tehsil is 1,250 females for every 1,000 males. Since the sex-ratio at birth is reasonably balanced as indicated by the various census reports and since there is no evidence that mortality is higher among males than among females, this unbalanced sex-ratio indicates large-scale out-migration of the male population and indirectly reveals the lack of employment opportunities in the tehsil. The sample survey undertaken in 106 villages in the tehsil (see Chapter II) confirmed this. In many of these villages, a very large proportion of the adult male population were working outside the tehsil at the time of the survey.

TABLE III.3 : AGE COMPOSITION OF THE POPULATION IN PAURI TEHSIL (1971)

Age groups		Persons	Percentage
0—19		1,03,640	51.00
20—55		79,457	39.10
55 and above		20,118	9.90
	Total :	2,03,215	100.00

Table III.3 presents the age composition of the population in the tehsil. It can be seen that only 39 per cent of the population belong to the age group of 20-55. Data on

* Mukerji and Dass (1940-42), *Studies of Kumaon Hill Soils*, quoted in Ray Chauduri and others, *Soils of India*, I.C.A.R., New Delhi, 1962 (page 319).

the actual working force in the tehsil in 1971 and its sex composition are not yet available. It is quite possible, however, that many adult males of this age-group who are working outside the tehsil were not counted during the census. Fifty-one per cent of the population is below 20 years of age. Until detailed data on 1971 census are available, it is difficult to estimate the proportion in this age-group which is also in the working force.

Growth of Population

During the past decades many administrative reorganisations and changes in the administrative boundaries of the tehsil have taken place. The comparability of the available data has also been lost to a great extent because of this. During 1960, the new district of Chamoli was formed and a part of the erstwhile Chamoli tehsil was added to Pauri tehsil. To overcome these computational difficulties, census data of 1951-71 has been used and the population of the tehsil in 1951 has been adjusted to its jurisdiction.

TABLE III.4 : VARIATION OF POPULATION DURING 1951-1971

Year	Persons	Decade variation	Percentage decade variation	Male	Female
1951	1,58,587	—	—	67,586	83,366
1961	1,77,868	19,281	12.12	78,678	99,190
1971	2,03,215	25,347	12.47	90,318	1,12,897

Table III.4 reveals that there was a very slight increase (.35 per cent) in the rate of growth of population in the last decade as compared with the previous one. It is also seen that the annual growth rate is far below the national average. Available data on the birth and death rates in the area are unreliable but there is no evidence that they are unusually different from the national rates. The almost stationary population during the last decade can, therefore, only point to the heavy out-migration from the area to other places.

Occupational Structure

According to the 1961 census, the population of the district was distributed between workers and non-workers in the ratio of 64.5 to 35.5. This is nearly in reverse order to the corresponding ratio of workers and non-workers in the state (39.1 : 60.9). It will be misleading, however, to interpret this high percentage of workers as an index of a high degree of development. A large section of the workers works actually only part-time in the agricultural sector. Also, due to out-migration of adult male workers, women work in the fields in large numbers. The occupational classification of workers during 1961 is given in Table III. 5.

It may be noted from Table III.5 that about 84 per cent of the working population was engaged in the Agricultural Sector in 1961. None of the other sectors had more than 7 per cent working population. The workers in household and manufacturing industries constituted less than three per cent. In case of urban workers, however, the distribution was much more balanced and the services sector had the highest representation (36 per cent).

Table III.5 : Occupational Pattern in Pauri Tehsil (1961)

S. No.	Occupation	Rural Total	Rural Percentage	Urban Total	Urban Percentage	Total working Population Total	Total working Population Percentage
1.	Cultivator	94268	85.84	1223	26.97	95491	83.50
2.	Agriculture labour	516	0.47	20	0.45	536	0.49
3.	Mining, quarrying livestock, forestry etc.	3547	3.23	161	3.56	3708	3.24
4.	Household industry	2054	1.87	166	3.63	2220	1.94
5.	Manufacturing other than household	868	0.79	247	5.45	1115	0.98
6.	Construction	1043	0.95	338	7.45	1381	1.21
7.	Trade and commerce	922	0.84	460	10.15	1382	1.21
8.	Transport & communication	824	0.75	303	6.67	1127	0.96
9.	Other services including Govt. services	5776	5.26	1618	35 67	7394	6.47
	Total :	109818	100	4536	100	114354	100

Land use : The land utilization pattern in Pauri tehsil in 1973 is shown in the following Table (Table III.6).

Table 3.6 : Land Utilization Pattern in Pauri Tehsil (1973)

Type of use	Area in hectares	Percentage to total geographical area
Forests	1,24,100	56.20
Barren & uncultivable	11,100	5.01
Land put to non-agricultural use	8,900	4.02
Cultivable waste	8,800	3.98
Permanent pasture and grazing land	10,300	4.66
Miscellaneous tree crops	3,000	1.36
Current and other fallows	11,500	5.14
Net sown area	43,400	19.63
Total :	2,21,100	100.00

A study of the land use pattern (Table III.6) clearly indicates the predominance of forests which occupy 56 per cent of the total geographical area. This pattern of land use is determined primarily by the physical nature of the ground. By reason of elevation and rugged relief, poor and slowly forming soils, the tehsil provides only submarginal lands for agriculture. Out of the reporting area of 2,21,100 hectares, the net sown area is only 43,400 hectares (19.63 per cent). The percentage of area under fallow and cultivable waste which can be brought under the plough by adopting soil conservation methods and irrigation, constitutes only 9.12 per cent of the total area. The percentage of area occupied by pasture and grazing land is 4.66 per cent.

Forests. Forests are the major natural wealth of the tehsil. They can be broadly classified into coniferous and non-coniferous types of trees. The main coniferous trees found in the area are *Chair* (Pine), *Deodar, Fir* and *Spruce*. The non-coniferous trees can be subdivided into *Banj* (Oak), *Sal* and *Kharsu*. A major portion of the forest area is occupied by Oak and Pine trees. While Pines are found at an altitude of 450 metres to 2,300 metres, Oaks grow at 1,500-2,100 metres. Deodars grow only in very high altitudes varying from 2,000 to 2,600 metres. A large number of herbs such as *Jhula* and *Samoya* are also found in the tehsil. While *Jhula* is used for packing purposes and as a raw material for many dyes, *Samoya* is used for perfuming tobacco. A large number of other unidentified herbs which are used by villagers for home treatment are also found in the tehsil.

Agriculture. As indicated earlier, in terms of the number of people employed, agriculture is the main occupation in the tehsil although the net sown area is very small.

The major crops cultivated in the tehsil are paddy, wheat, barley, *mandua* and *jhangora*. In addition to these, pulses, vegetables and tobacco are also grown on a small scale. ~~The cropping pattern is mainly~~ governed by the slope of land and irrigation facilities. Paddy and wheat are cultivated in the valley and in those areas where irrigation facilities are available. In these areas the first crop (*kharif*) is generally paddy which is followed by wheat in *rabi*. *Mandua* and *jhangora* which do not require irrigation are cultivated on the uplands. The area under *mandua* is generally kept fallow in *rabi* and in the succeeding year, is brought under paddy cultivation. *Barley* often follows the *kharif* crop of *jhangora*.

The production of major crops in the Tehsil during 1973 is shown in Table III.7.

TABLE III.7: PRODUCTION OF MAJOR CROPS IN PAURI TEHSIL (1973)

Name of crop	Production in tonnes	Percentage to total production
Rice*	6450	24.09
Wheat	8030	29.98
Barley	1700	6.35
Mandua	7320	27.33
Jhangora	2280	8.52
Pulses	1000	3.73
Total :	26780	100 00

* The ratio of paddy to rice = 1 : .66

Animal Husbandry. Livestock rearing is practised by the farmers as a subsidiary occupation to supplement their farm income. The farmers rear a good number of cows, buffaloes, goats, sheep, etc. but the breeds are usually inferior and the feed is poor. Since there is restriction on grazing in the forest areas, the feed mainly consists of the residue of cereal crops which is highly deficient in nutrition. The total number of livestock in Pauri tehsil is estimated at 4,85,000 excluding poultry. The following Table (III.8) gives the estimated figures of livestock and their yield.

TABLE III.8 : LIVESTOCK IN PAURI TEHSIL (1961)

S. No.	Livestock	Number	Type of product	Annual production in Kg. per animal
1.	Cattle	2,50,000	Milk	110
2.	Buffaloes	1,10,000	Milk	325
3.	Goats	80,000	Milk	55
4.	Sheep	25,000	Wool	0.32
5.	Horses	5,000	—	—
6.	Others	15,000	—	—
	Total :	4,85,000		

Table III.8 shows that cattle form the largest proportion of animals in the tehsil. Most of them are of a non-descript type and the average annual yield is about 110 kg. of milk per animal. Recent studies by the National Commission on Agriculture* show that cattle rearing would be economical only if the stock gives an yield of 1,800-2,000 kg. of milk annually. Though there are about 25,000 sheep in the tehsil, the production of wool is not handled in an organised manner. Villagers keep sheep mostly to meet their requirement of wool and shearing is not done regularly for commercial purposes. Production of wool is also extremely poor. The average per animal annual production is 0.82 kg. of wool whereas an exotic breed gives an yield of 2.5 kg. to 3 kg. of wool annually.

Sericulture. The climate and soil of Pauri are quite suited for sericulture. At present silk worm rearing is practised at Bilkhet in Kalgikhal blocks and in Khirsu. Both mulberry and tassar silk worms are reared in the tehsil. While the former depend on mulberry trees, the latter depend on oak trees for sustenance. The present sericulture activity is limited to the stage of producing cocoons. The subsequent operations are being done outside the tehsil.

Horticulture. The climate and soil conditions of Pauri are quite favourable for growing a large variety of fruits. While fruits such as apples, plums and walnuts which require a cold climate are grown on the ridges, tropical fruits such as mangoes, guavas, lemons are grown on the plains and valleys. The total area under horticulture in the tehsil is

* National Commission on Agriculture, Government of India, *Interim Report on Milk Production by Small and Marginal Farmers,* August, 1973.

3,000 hectares of which more than one-third is under apple cultivation. The important orchards are located at Srinagar, Khirsu, Khaproli, Bharsar and Khandiunsain. All these orchards are under the control of the Fruit Utilization Department of the Government of U.P. The private orchards are confined along the two sides of the Pauri-Srinagar, Pauri-Bahbazar and Pauri-Satpuli roads. As regards institutional facilities, there is a horticulture research centre at Srinagar and horticultural protection mobile sub-centres at Pauri, Khandiunsain, Kaskheth, Thailisain and Pabau.

Industries. Though Nature has favoured the tehsil with a large number of resources there is no sign of industrial development in the tehsil. Except the recently established turpentine factory at Pauri there is no major industry in the tehsil. There are a few small-scale industries but their production and investment are very low. Among the few places where cottage industries are located, Pauri stands first. A shawl weaving unit and a rough woollen cloth manufacturing unit are functioning in Pauri. In the Thailisain block, coarse cloth using Bhang fibre which resembles jute, is woven. Carpets are also made from local wool for domestic uses. In the Pabau block, household utensils are made on a small scale and sold among the villagers.

Trade, Commerce and Banking. From the point of view of trade and commerce, the tehsil is quite backward. The major commodities of export from the tehsil are the forest produces such as timber, resin, herbs and horticultural products. The imports consist of consumer goods such as foodgrains, pulses, sugar, textile goods and foot-wear. The imports far exceed the exports. The production of food crops falls short of the total requirements by about 50 per cent and hence the import of foodgrains is the highest.

The unsatisfactory development of trade and commerce is mainly attributed to the poor accessibility of the area, exorbitant tıansportation cost and economic backwardness of the people. Of the very few market centres in the tehsil, Pauri, Srinagar and Rudraprayag are the most important. Pauri is the biggest centre and caters to the needs of a large population of the district. The importance of Srinagar and Rudraprayag is due to their locations at the borders of the neighbouring districts of Tehri-Garhwal and Chamoli. They are also on the important pilgrimage route connecting Hardwar with Kedarnath and Badrinath.

As regards banking facilities, there are only a few money-lending agencies in the tehsil. At Pauri, the State Bank of India and the District Cooperative Bank have their branches. At Srinagar, there is one branch of the Punjab National Bank. These commercial banks and the cooperative banks in the block headquarters, provide the banking system in the tehsil.

Transportation

The existing transportation facilities in the tehsil are far from satisfactory. A large number of villages is not accessible by road. The total length of all-weather motorable roads during 1971 was 303 km. of which 180 km. were under the maintenance of Public Works Department and 50 km. under the Director-General of Border Roads. The remaining road length which mainly passes through the forest areas was under the control of the Forest Department. Details of road mileage, surface conditions and the important markets linked are given in Table III.9.

Among the major roads (Table III.9), Satpuli-Srinagar road is a part of the highway connecting Kotdwara and Srinagar. This road also connects a number of market centres in the tehsil.

TABLE III.9: MAJOR ROADS IN THE PAURI TEHSIL (1971)

S. No.	Name of road	Length in km.	Nature of road surface	Linked markets
1.	Satpuli-Srinagar	67	Bituminous	Piplipani Jakhoti Parsundhakhal Pauri
2.	Pauri-Nautha	43	Metalled	Pabau Chifalghat
3.	Pauri-Sabdarkhal	37	Metalled	Khandiunsain
4.	Satpuli-Kanskhet	25	Unmetalled	Banghat
5.	Pabau-Santudhar	8	Unmetalled	Kanskhet
6.	Pauri-Kanskhet	31	Unmetalled	Adhwani
7.	Pauri-Phurkhauskhal	32	Unmetalled	Chambatiakhal
8.	Adhwani-Nahsain	10	Unmetalled	
9.	Srinagar-Rudraprayag	50	Bituminous	Bhattisera Sumerpur Ratura
	Total :	303 Km.		

Power. Pauri tehsil is surrounded by large perennial rivers on three sides and has good hydro-electric potential. However, the tehsil is still dependent on the diesel power station at Pauri for its power requirement. The power station at Pauri has six generators each having an installed capacity of 550 K. watts. Until 1971, only three urban centres namely, Pauri, Srinagar and Bahbazar had electricity. No villages were electrified until recently. During the period 1971-73 only 15 villages were electrified. A major portion of the electric consumption in the tehsil comes under the category of domestic use. To date, power consumed by industries and for irrigation purposes is very marginal.

Drinking water. Springs and streams are the main sources of drinking water in the tehsil. In normal seasons there is no scarcity of drinking water but villagers have to walk long distances to get to the source of water. Very often, this involves climbing a few kilometers everyday. Only very few centres are covered by protected water supply (Table III.10). In some villages, water is supplied through pipelines directly from the sources. The following are the major water supply schemes in the tehsil.

TABLE III.10: CAPACITY AND UTILIZATION OF WATER SUPPLY SCHEMES, PAURI (1973)

S. No.	Location	Total installed capacity galls/day	Duration of supply (hours per day) Normal season	Dry season	Population served	Source
1.	Pauri	39,000	4	4	9,000	Springs
2.	Srinagar	20,000	7	6	6,000	River and springs
3.	Devprayag (Bahbazar)	25,000	12	8	2,500	Stream
4.	Kaljikhal and surrounding settlements	33,000	24		3,300	Springs
5.	Thailisain and surrounding settlements	7,500	24		1,150	Springs

Education. The number of literate persons in the tehsil is estimated as 63,000 comprising 44,500 males and 17,500 females.

TABLE III.11: COMPARISON OF LITERACY 1951-1971 PAURI TEHSIL

Year	Male		Female		Total	
	Number of literate persons	%	Number of literate persons	%	Number	%
1951	22,800	33.90	1,990	2.40	24,790	15.60
1961	33,800	43.00	5,950	6.00	39,750	21.64
1971	46,000	51.00	18,000	16 00	64,000	31.53

Table III.11 shows that literacy in the tehsil, though low, is steadily increasing. During the last two decades, it has doubled. The literacy of female population is still very low although there has been considerable improvement in recent years.

As regards educational institutions, most of the primary and middle schools are under the management of the Department of Education. On the other hand, most of the higher secondary schools and colleges depend on private contributions. Details can be seen in Table 3.12 (Fig. III.4).

TABLE III.12: EDUCATIONAL INSTITUTIONS IN PAURI TEHSIL (1973)

S. No.	Institution	Number
1.	Primary schools	397
2.	Junior high schools	56
3.	High schools	12
4.	Junior colleges	12
5.	Degree colleges	2
6.	Industrial Training Institute	1
7.	Other institutions	4

Health. Health facilities in the tehsil are extremely poor. Although a few facilities exist in the urban areas and in the block headquarters, the rural areas are totally devoid of any health facilities. At present, there are two civil hospitals in Pauri and one in Srinagar (Fig. III.5). One of the two hospitals in Pauri is for female patients only. In addition to these, there are primary health centres located in block headquarters.

Communication. Pauri tehsil is seriously deficient in postal and telegraphic communications. Since the villages are widely spread over the tehsil, the number of post and telegraph offices should have been more compared with the plain areas where the villages are clustered together. Over 1,300 villages and three urban centres in the tehsil are served by

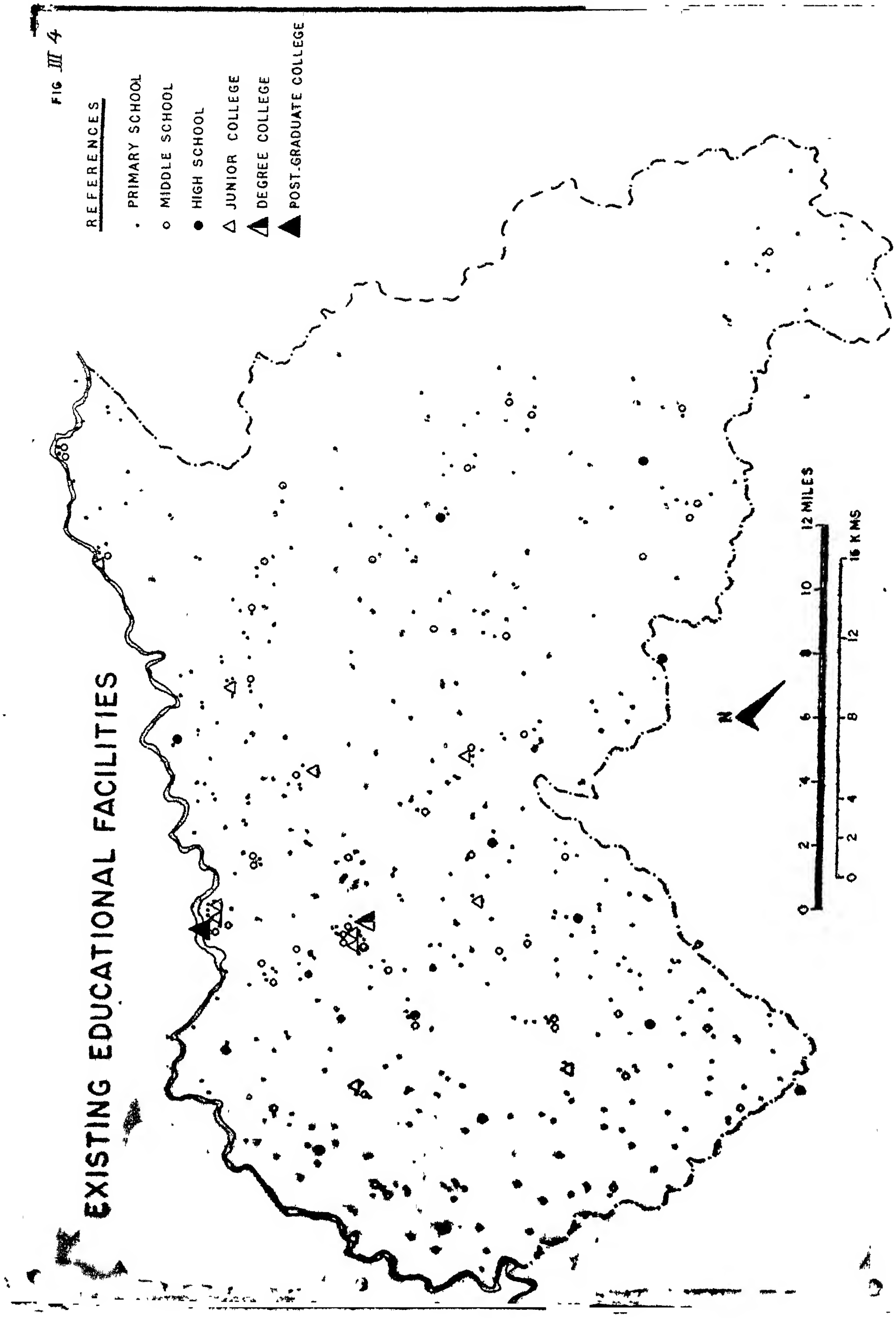
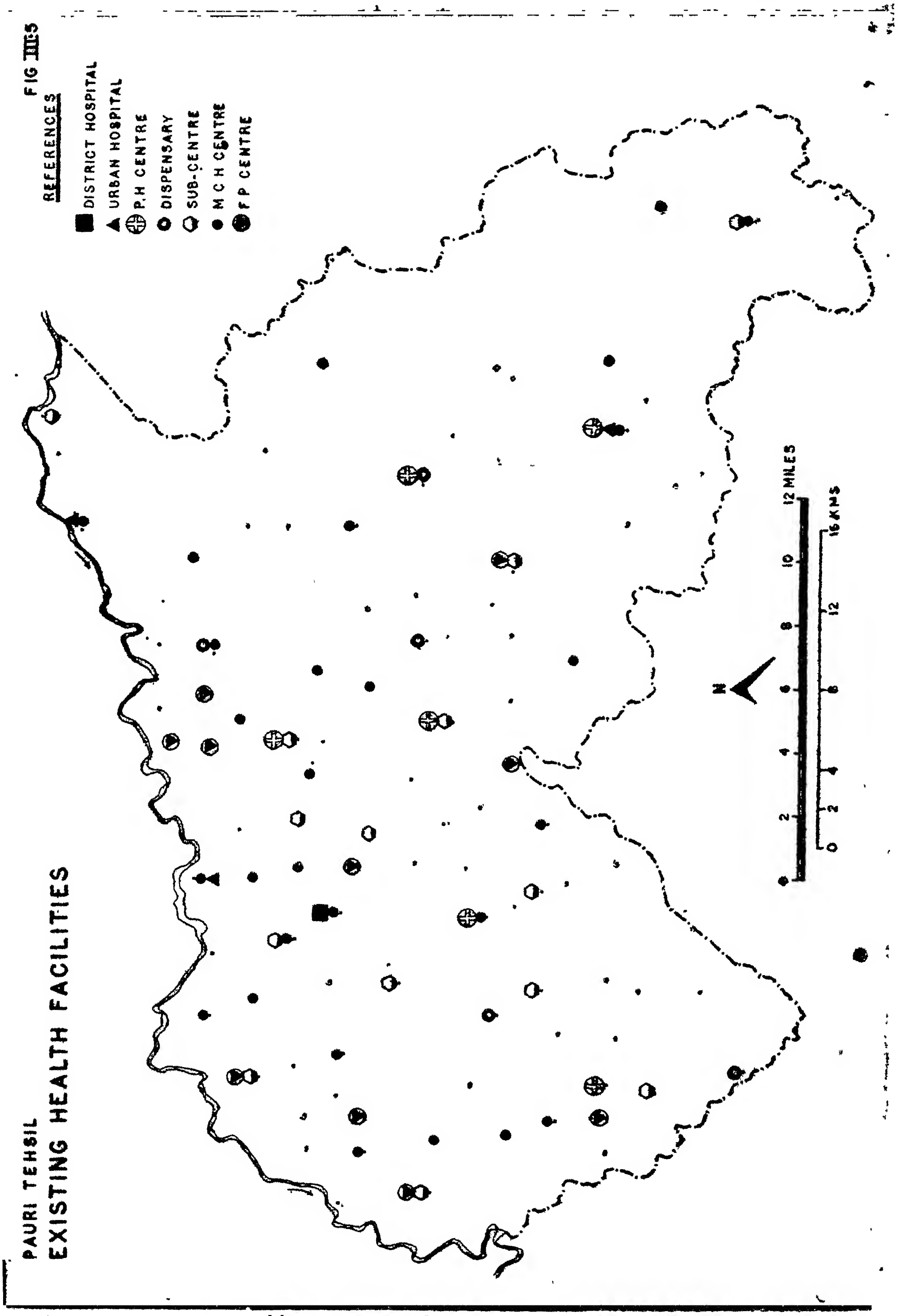


FIG III 4
EXISTING EDUCATIONAL FACILITIES
REFERENCES
PRIMARY SCHOOL
MIDDLE SCHOOL
HIGH SCHOOL
JUNIOR COLLEGE
DEGREE COLLEGE
POST-GRADUATE COLLEGE
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS


PAURI TEHSIL
EXISTING HEALTH FACILITIES
FIG III.5
REFERENCES
DISTRICT HOSPITAL
URBAN HOSPITAL
P.H CENTRE
DISPENSARY
SUB-CENTRE
M C H CENTRE
F P CENTRE
N
12 MILES
16 KMS
0
2
4
6
8
10
12

one head post office, 23 sub-post offices and 102 branch post offices only. Among the sub-post offices, 11 are provided with telegraphic facilities and six with both telegraphic and telephonic facilities. All these post offices are under the jurisdiction of the head post office located at Pauri (Fig. III.6).

Extension Services

In the study area the supply of improved seeds, fertilizers and pesticides are carried out through the block development offices and a network of VLW offices and cooperative societies. There are 60 VLW offices and 89 primary agricultural cooperative societies in the tehsil. The credit facilities to the farmers are provided through the block headquarters, agricultural cooperative credit societies and the banks. There are six agricultural cooperative credit societies located in different parts of the tehsil. The branches of District Central Cooperative Bank which provide credit to the farmers are located at Pauri and Srinagar.

The soil conservation units located in 10 centres covering the whole tehsil take up the soil protective measures in the tehsil. In addition, the Area Development Agency has formulated certain programmes for soil conservation. The Gagwarsyun water shed area is one such project which envisages adoption of various soil conservation measures, levelling, stone bunding, pasture development and afforestation. The project is proposed to cover an area of 1,216 hectares. This pilot project will also serve in demonstrating the effectiveness and utility of scientific soil conservation measures to the farmers.

For the health coverage of livestock in the tehsil, there are eight veterinary hospitals located in the six block headquarters and at Parsundakhal and Rudraprayag. In addition, there are 18 veterinary dispensaries and stockman centres located in different parts of the tehsil.

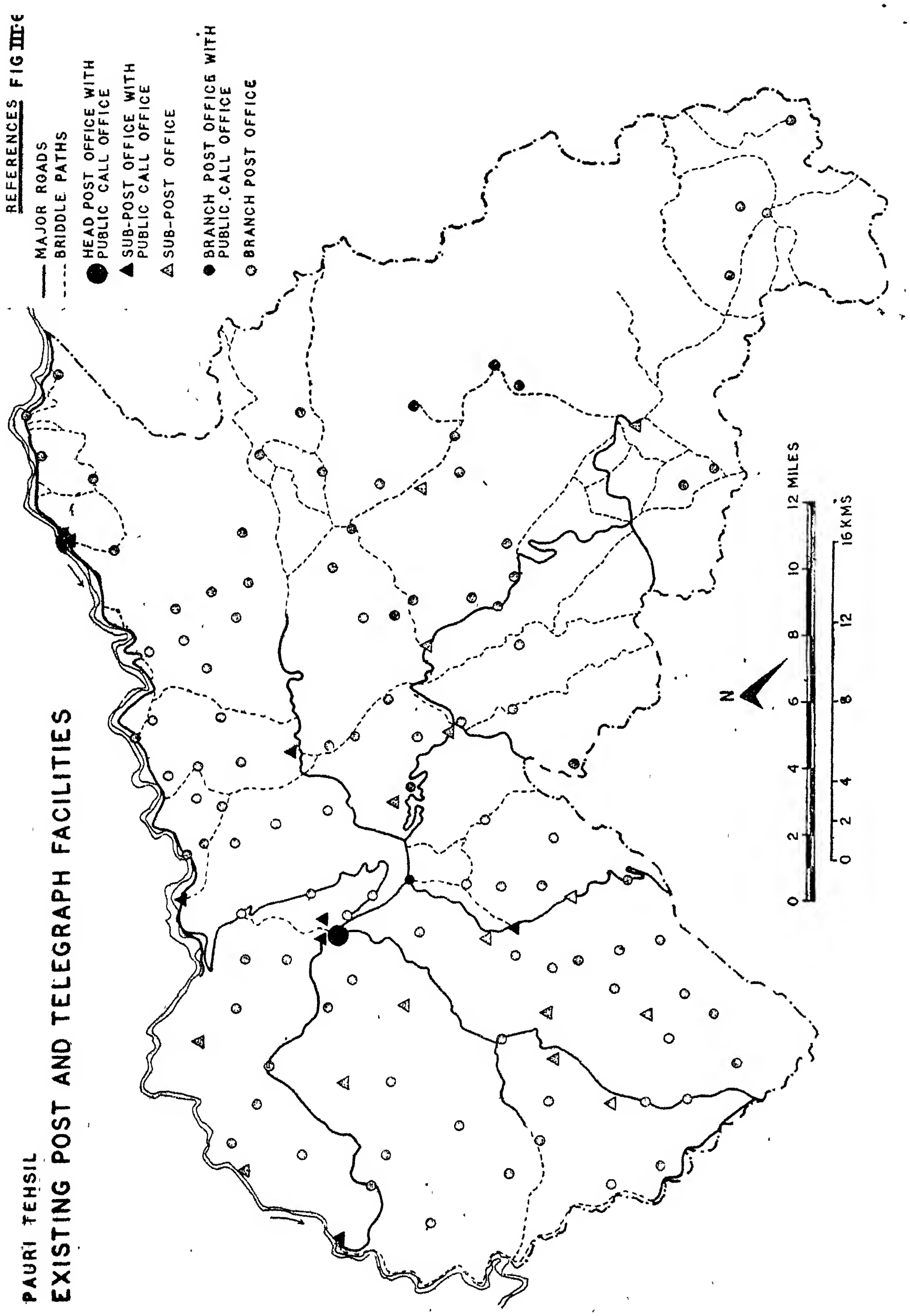
Summary and Conclusions

Hill areas are not only topographically different from the plains but also present a very different set of problems for planners and programme administrators to solve.

Pauri tehsil occupies an area of 2,211 square kilometers with a population of 2,03,215 which are about the same as an average tehsil or taluk in the plains has. However, Pauri has 1,392 settlements (including three urban centres) whereas an average taluk has about 150 settlements. The average village population is only 153 (counting inhabited villages only). The corresponding figures for an average taluk in the plains is about 1,000.

This highly dispersed population and a large number of small settlements located at various altitudes in a hill area present one of the most difficult problems of transportation and communication. The reasons why settlements are so small in size and so widely dispersed in space in this tehsil have been analyzed in a later chapter. The planner and the programme administrator are, however, left with the problem of integrating this mass of human habitations into the mainstream of development by providing development inputs and outlets for their economic activities and also by providing minimum amenities of life such as drinking water and educational and health facilities.

Aside from the problem of logistics of reaching such a large number of settlements in a hilly area, the planner is also faced with the problem of the economic viability of investments in such small habitations. Without a viable population base, the provision of services


PAURI TEHSIL
EXISTING POST AND TELEGRAPH FACILITIES
REFERENCES
FIG III·6
MAJOR ROADS
BRIDDLE PATHS
HEAD POST OFFICE WITH PUBLIC CALL OFFICE
SUB-POST OFFICE WITH PUBLIC CALL OFFICE
SUB-POST OFFICE
BRANCH POST OFFICE WITH PUBLIC CALL OFFICE
BRANCH POST OFFICE
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

may forever remain a liability of the government. The question of grouping small settlements in a meaningful way for enlarging the population base has been discussed in a later chapter.

The tehsil has no dearth of water. The average annual rainfall is 60 inches. Three rivers, Alaknanda and East and West Nayars skirt the tehsil on three sides. In addition, a large number of springs and small streams flow down the slopes of the hills. Yet most of this large water resource remains unutilized because of the topography of the land. The rivers are too deep, except in the valleys, to be of use for irrigation or industrial purposes. No economical method has yet been found for lifting river water or storing spring water for distribution to a maximum number of settlements. The heavy rains cannot be stored and they run down the hills causing serious damage to the precariously terraced agricultural lands on the slopes and also causing serious soil erosion.

Very little information is available on the mineral resources of the area. It is known, however, that there are reserves of iron and copper ores, limestone and mica in different parts of the tehsil. The quantum of the reserves and whether its exploitation is economically feasible are not yet known. For the next decade or so, one can, therefore, only plan for the development of activities such as agriculture, horticulture, sericulture and forestry.

The main activity in the tehsil is agriculture as more than 80 per cent of the working force is engaged in it although the net sown area is only about 20 per cent of the total geographical area. This shows the tremendous pressure on the limited amount of the agricultural land. Most of the cultivators are owner farmers and per capita landholding is extremely small. Because of terracing, even the small landholdings are fragmented into very small plots. Agriculture is primarily confined to subsistence farming which has contributed to the extreme low productivity of crops. The area, as a result, is chronically short of food and has to be supplied from outside sources.

Potentially, the most important natural resources of the area are the forests which cover 56 per cent of the total geographical area and contain many varieties of trees with commercial and industrial possibilities. Unfortunately, a full economic utilization of these rich forests has yet to be made. On the contrary, illegal cutting of firewood and indiscriminate grazing are denuding the forests resulting in soil erosion and depletion of a valuable natural wealth.

The soils, altitudes, slopes, rainfall, drainage and temperature in most parts of the tehsil seem ideal for horticulture. Yet only about two per cent of the total geographical area is under fruit trees. Much of the slopes which is currently under terraced agriculture should logically be converted into horticultural land. This will reduce soil erosion from continuous ploughing of the soil and will also introduce profitable commercial horticulture to the local people. At present horticulture is only a subsidiary occupation in the tehsil mainly because of the lack of marketing, storage and transportation facilities. There is shortage of land also as most of the available land is under terraced agriculture.

There is also a good scope for the development of animal husbandry in the area. Currently, animals are bred and reared only as a subsidiary occupation to agriculture and animal products are consumed locally. The proportion of grazing land to the total geographical area is only about 5 per cent. In spite of some illegal grazing, forest lands are out of bounds to domestic animals. The livestock and their products are of poor quality and the quantity sub-average. The fodder problem can be solved by converting some of the agricultural land to fodder growing. Coupled with a vigorous programme of improving the stocks,

this should improve both the quality and quantity of livestock products in the area. Animal husbandry on a commercial scale should compensate the local people enough to sustain the loss of food crops and also make a good margin of profit.

There are no mineral-based industries in the area. Without precise information on mineral deposits and in the absence of feasibility studies for their exploitation, it is not possible to predict the prospects of such industries in this area at this time. The question of agro-based industries also does not arise in this area as it is chronically short of all agricultural products. There is scope, however, for the development of industries based on horticulture, animal husbandry and forestry provided these activities are supported by strong development programmes and provided these activities are taken up on commercial scale. Only a very few forest-based industries are now in operation in the tehsil and in the rest of the district. A few allied activities such as sericulture have also been started in the area on an experimental level.

The most important resource of Pauri-Garhwal is of course, its people. Anyone who has visited the area has been impressed by the hardy, hardworking and honest people of Garhwal. Because of the economic backwardness of the area and lack of employment opportunities, a large number of men in the working age group have left the area in search of jobs elsewhere. Also a large number enlist themselves in defence services every year. It is not uncommon to find only women, oldmen and children in a Garhwal village with most adult males gone.

In short, the study area presents a picture of poverty and backwardness existing side by side with vast natural wealth and a hard working people. Left to itself, the area will remain backward due to the unique set of interlocking problems discussed earlier in this chapter. Water conservation, soil conservation and road linkages should receive priority in any planned effort for developing this area. Where road construction is costly and time-consuming, power-operated ropeways should be used for opening up the interiors for easy and quick movement of goods. Agriculture as the main economic activity should be gradually moved over to commercial horticulture, animal husbandry, forestry, sericulture and other allied activities. An adequate infrastructure of input distribution, storage, marketing, processing, road linkages and power lines should be laid out in support of these activities and a well coordinated vigorous extension programme should be organised to help local people switch over to new activities and adopt new techniques. Minimum social amenities of drinking water, education, health and veterinary services should also be optimally located within easy reach of each village.

Plan recommendations for the development of these facilities have been made in the remaining chapters of the book.

CHAPTER IV

IDENTIFICATION OF GROWTH CENTRES, SERVICE CENTRES, CENTRAL VILLAGES AND THEIR HINTERLANDS IN PAURI TEHSIL

The main objective of micro-level planning as indicated in Chapter I is to bring development down to the village level so that the fruits of development can be shared by as many people as possible. Keeping this ultimate aim in view, the planner's task is to identify the most optimum and viable unit of planning which should be as close to the village as possible.

It has been explained in Chapter I that although the village is a clearly identifiable unit of human habitation, it is too small to be considered a planning unit. A village cannot support most services and functions unless it has a hinterland consisting of other villages to support these. The planning unit which should be able to sustain important services and functions must, therefore, include a number of villages. The grouping or clustering of villages will provide a larger population and resource base than a village.

The advantage of taking village-clusters as planning units over taluks or blocks is that they are small enough to make the impact of development felt at the village level. The actual location of new development programmes can also be very easily ascertained in a small area than in a taluk or a block. It should be pointed out in the beginning that for major investments, the population base required will be larger and these small clusters may not be able to provide a viable base. Later in this Chapter, this problem has been examined and a hierarchy of planning units with progressively larger area and population has been identified for investment of various orders and scales.

The need for identifying planning units which are bigger than the village but small enough for efficient implementation of development programme is particularly relevant in the case of Pauri tehsil. As we have seen in Chapter III, Pauri tehsil has 1,207 inhabited villages with an average population of 153 per village. The number of villages is so large for such a small area and the average population so small that it will be impractical to suggest service and development functions for each and every village. In the case of Pauri tehsil, the only feasible solution is to group the villages into a number of clusters. Given the underdeveloped conditions in the transportation system and the meagre resources of the ordinary villager which drastically limit his sphere of activities, the basic planning unit should not be too large. A small group of villages with a central village as its focal point and with functional inter-linkages, should be the ideal unit for planning. A unit of this size should provide the base of (1) meaningful aggregated estimates of resources as well as needs, (2) a large enough population and at least a rudimentary infrastructure for future investment, and (3) the implementation of location-specific programmes.

The exercise of delineating such clusters must, however, be based on certain guidelines so that the grouped villages also correspond to real functional units.

It has been observed by regional scientists that most settlements maintain functional linkages with other settlements particularly in trade and services. It is not difficult, if the exact functional linkages are known, to draw boundaries around villages which form a group

by such functional ties. It is also known that the geographical range of trade and service relations vary (making the size of the clusters, small or large) with the degree of specialization of the trade or services in question. For example, a villager will find his daily food either in his own village or in the next. But he may have to travel a long distance for buying fertilizer or selling his farm produce to a wholesaler. A village may, therefore, be at the centre of many concentric circles with progressively increasing radii depending on the nature and the degree of specialization of functional linkages.

Central-place Theory

This seemingly confusing interrelations can be clarified and easily understood with the help of existing theories and concepts. The theory which is most relevant for the purpose of the present study is the central-place theory mainly associated with the name of W. Christaller. John Galpin's discovery of the circular shape of the zones of influence of grocery stores in rural America and John Kolb's delineation of the hierarchy of trade centres in the early part of the century has been refined and put on a mathematical foundation by Christaller, Loesch and many others*. The central-place theory, stripped of details, consists of the following postulates :

1. A central place (usually a city, a town or a large village depending on the specific area or region under study) which provides functions and services to its tributary area, is located at the centre of minimum aggregate travel providing minimum cost to the customers and maximum profit to the sellers.

2. There is a hierarchy of such central places. The higher-order places offer functions normally available in lower-order places but in addition, they also provide specialized functions which lower-order places do not have.

3. Higher-order places not only have their unique functions but also offer lower-order functions in larger numbers and volume than do the lower-order places. The reason for this is that the higher-order places command a larger trade area and customers minimise their travel cost by shopping higher and lower-order goods in the same places.

4. Functions which are unique to higher-order places have a wider range (geographical area of influence) than lower-order functions which are common to both higher and lower-order places.

5. It follows that higher-order places, because they have such wide-ranging functions, command a larger tributary area than lower-order places. In other words, their degree of centrality is higher than that of lower-order places.

6. The higher-order functions are fewer in number and more widely located in space than lower-order functions.

7. It follows that the higher-order places which possess higher order functions are also fewer in number and more widely spaced than the lower-order places.

8. There is a step-by-step hierarchy of central places ranging from the highest-order place to the lowest-order place with each order of place "nesting" the next lower-order places.

Ideally, the command or the tributary area of a central place is shaped in the form of a hexagon to provide maximum efficiency. The "nesting" pattern or latticing of lower places within such a command area is determined by three principles : (1) marketing, (2) traffic, and (3) administrative.

According to Christaller, the centrality of a place is a measure of its importance. He recognizes population size as an associative factor but the major emphasis is placed on the functional importance of a place in terms of the nature and the range of services offered.

Growth Centre Concept

The theoretical postulates and concepts of the central-place theory describe an evolutionary pattern of hierarchic relationships among settlements based on functional interlinkages. These relationships do exist in reality although may not be in such pristine form. These provide a vast network of specific linkages over which day-to-day commerce and other activities flow. The dynamics of people's activity patterns follow the hierarchic arrangement of settlements in space.

The problem of the planner is how to utilize the spatial network of functional interlinkages for bringing about a balanced development of a region. The need for planning arises when there are imbalances in the development of a region and also when only limited resources are available for correcting the imbalances. Left to itself, growth emerges only in a few places due to very specific reasons. With time, this selective development perpetuates itself and more and more social and economic activities are concentrated in the few favoured places at the cost of the rest of the region.

Decentralization of social and economic activities away from the major centres is one of the basic strategies used by a regional planner. Central-place theory provides a model by which this can be done. Indiscriminate *ad hoc* decentralization of investments rarely serves the purpose of development. The funds made available by the government for balanced regional development under various heads must be coordinated with the existing pattern of spatial interlinkages. Where such interlinkages are absent, the central-place theory provides guidelines for simulating a spatial interaction model for planning.

The model which has been used in this study for preparing an integrated area development plan for Pauri tehsil is based on the growth centre concept modelled very closely on the postulates of the central-place theory*. Growth centres are central places which service a hinterland consisting of a number of villages. They provide optimal locations for selective investments in agricultural and industrial infrastructure and social facilities which can be used by the hinterland population. Since it is not possible to locate every function in every village, the priority must go to the growth centre or a potential growth centre. The hinterland villages of the growth centre are by definition geographically close and if adequate transportation linkages are provided, all hinterland villages can make use of the services provided in the growth centre.

Growth Centres, Service Centres, Central Villages and Dependent Settlements

There can be several ranks of growth centres depending on the centrality of these places and measured by their degree of functional complexity or their population size.

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* For a detailed analysis of the growth centre concept see Sen, Lalit K., (ed) *Readings on Micro-Level Planning and Rural Growth Centres*, Part I, NICD, Hyderabad, 1972.

Planners have used several nomenclatures for indicating these ranks. In our earlier studies, we have used a four-fold nomenclature for describing the entire range of settlements*. The four categories indicating a direction from least to most specialization are : (1) dependent villages, (2) central villages, (3) service centres, and (4) growth centres. The difference between one rank and the next higher or lower one is obvious. Each higher category provides more specialized services than the lower one. This line of thinking closely follows the postulates of central-place theory as enunciated by Christaller, Loesch, and others.

Method Used for Identifying Growth Centres, Service Centres, Central Villages and their Hinterlands in the Study Area

In our earlier studies, a simple method for identifying growth centres, central villages and their hinterlands was used*. In small areas where all settlements could be covered by the field team within a reasonable time period, people were asked to name the villages and towns where they went for different services. These movements were then mapped and the emerging patterns analysed. After the various functions and services were grouped at a few levels of a functional hierarchy, analyses of the movement patterns of people for each group of functions showed clear trends. For example, distances travelled for the lowest-level functions were comparatively shorter than distances travelled for the higher-level functions. The central places on which these movements converged could easily be identified on the map and the rank of the places ascertained by the level of functions sought in them.*

In large areas such as a district, where it was not possible to interview people in every village, villages above a certain population level were selected and the same method was applied. To complement this partial exercise, a theoretical model known variously as the gravity model, the spatial interaction model or the law of retail gravitation (or simply Reilly's Law), was used.† The application of this theoretical model was first tested for validity with empirical data from the respective study areas before its application.

In applying these methods to the present study area of Pauri tehsil, several interesting problems were faced. Although the total geographical area covered by the tehsil is small (about the same as an average taluk in the plains) it contains a very large number of settlements with very small populations. Since it was impossible within a limited time period to collect primary data on movement patterns from 1,389 villages, many of which are located in inaccessible areas and on different terrain, it was decided to use the gravity model (or Reilly's Law) for identifying central places and their hinterlands. Along with their analyses, primary data on actual movement patterns were collected from all towns, all villages with 300 population or more and all rural market centres. The total number of selected centres was 181 (3 towns, 106 villages with 300 people or more and 72 rural market centres). (Fig. IV.1).

Another major problem faced consistently in this area was the absence of secondary data needed for planning purposes. For an analysis of the settlement hierarchy, it was necessary to score the settlements on the basis of population size, presence or absence of

* Sen, Lalit K. *et al., Planning Rural Growth Centres for Integrated Area Development; A Study in Miryalguda Taluk*, NICD, Hyderabad, 1971; Sen, Lalit K. and Girish K. Misra, *Regional Planning for Rural Electrification: A Case Study in Suryapet Taluk*, NICD, Hyderabad, 1974; and Sen, Lalit K. *et al., Growth Centres in Raichur: An Integrated Area Development Plan for a District in Karnataka*, NICD, Hyderabad, 1974.

† Sen, Lalit K. *et al., Ibid.*, and Sen, Lalit K. *et al.*, op cit.

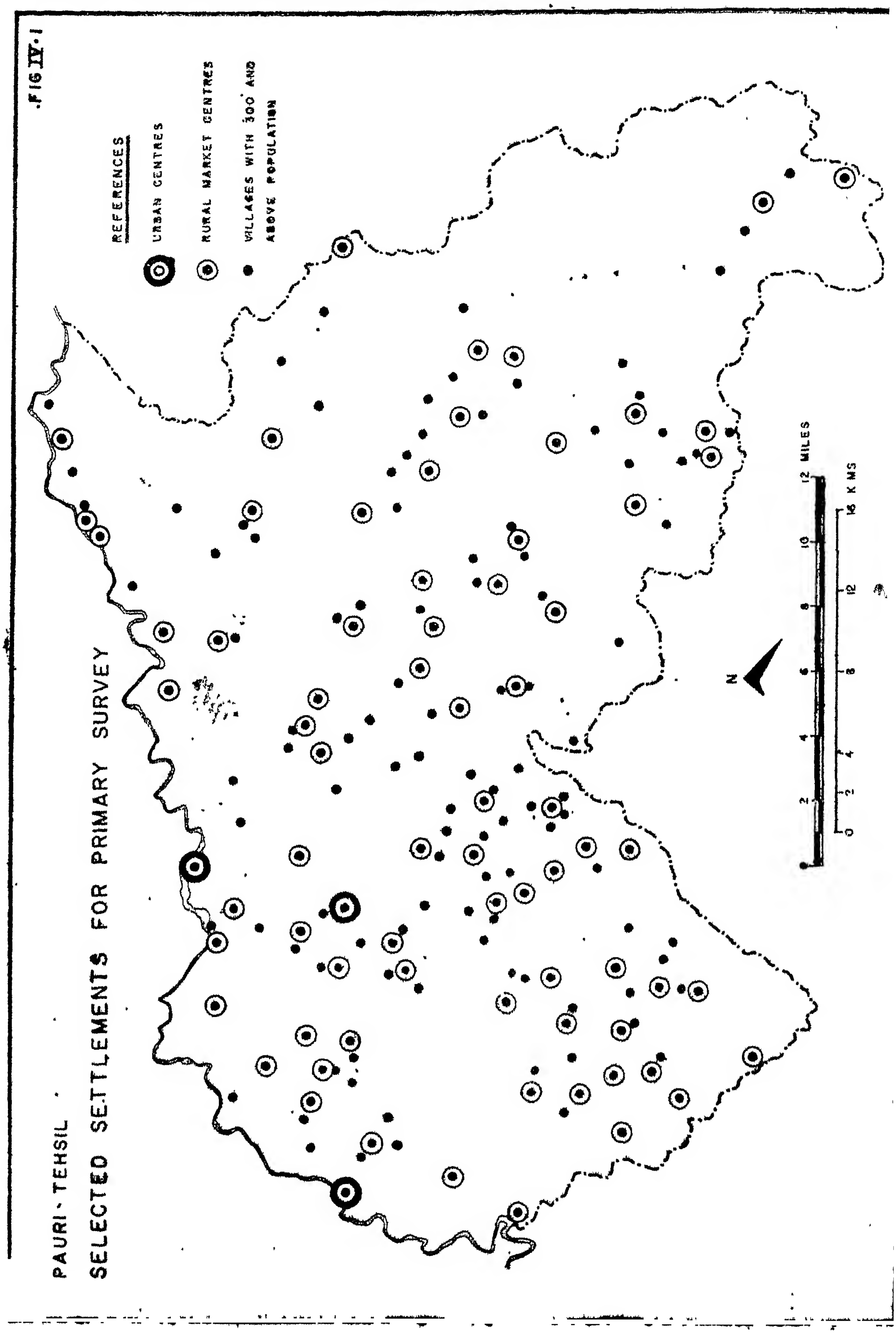


FIG IV.I
PAURI - TEHSIL
SELECTED SETTLEMENTS FOR PRIMARY SURVEY
REFERENCES
URBAN CENTRES
RURAL MARKET CENTRES
VILLAGES WITH 300 AND ABOVE POPULATION
N
12 MILES
16 K MS

various functions, number of people served and the total area served. Except for the 1971 population figures which were collected from the Census Office in Lucknow, there were practically no data on the remaining dimensions. It was decided, therefore, to limit the hierarchic analysis to the 181 settlements selected for primary survey. It was the impression of the field research team that these 181 settlements included practically all the central places of various orders in this area.

It was soon discovered that unlike in the plains, not only there was no significant correlation in the study area between centrality (based on functional complexity and importance) and population size, the correlation coefficient ($r = -$ 017 not significant) was actually in the negative direction.† The three towns, Pauri, Srinagar and Bahbazar were excluded from this analysis. (Fig. IV.2).

In searching for an explanation for the unusual phenomenon, it was discovered that this was the typical behavioural response of the people to their immediate environment. The rugged and difficult terrain and the cold climate of the area have compelled the people to select a central location for trade and services which is about equidistant from a group of villages and in a relatively more accessible spot, preferably on a road. Trades people and their customers come from the villages to open their shops in day time and go back to their villages again at Sun down leaving the market place deserted. Because a number of people from various villages converge on this central location, other services also slowly appear. As very few of these people actually live in these places, the population of these central locations as recorded in census is also very small. These places are almost invariably located on hill tops with sunshine all around the year, by the side of a spring, a river or a road and the land is relatively less undulating.

A typical example is Pokhrikhet market which is geographically central to four selected villages : Guinthali, Simtali, Chorkandi and Kyark. The four villages are located within a radius of two and half kilometers from Pokhrikhet and each has a reasonably large population. However, none of these four villages has any basic functions to speak of and they all depend on Pokhrikhet for all necessities. The population of Pokhrikhet, on the other hand, hardly adds up to 50.

Since population size is not indicative of the centrality of a settlement in this area, only the functional complexity score could be used as the degree of centrality of a place.

At the time of the application of the gravity model to the study area for delineating hinterlands of central places, it was discovered that the results were in wide divergence with the actual movement patterns of the people of the selected settlements. In studies done in the plains, these two were found practically identical.* It was soon discovered that the straight-line distance between two central places useable in a plain area** could not be used

† The correlation coefficients obtained in our earlier studies (Sen, Lalit K., *et al.*, Ibid) in Miryalguda, Suryapet and Raichur between centrality and population size were all 0.86, indicating a very high positive association. Similar high associations have also been observed in the plain areas in other countries. See for example, Stafford, H.A., "The Functional Bases of Small Towns", *Economic Geography*, Vol 39, pp. 165-75, 1963; Berry, B J.L. and W. Garrison, "Functional Bases of the Central Place Hierarchy", *Economic Geography*, Vol. 34, pp. 145-54, 1958; and Gunawardena, K.A., *Service Centres in Southern Ceylon*, University of Cambridge, Ph. D. Thesis, 1964.

* Sen, Lalit K., *et al.*, *Growth Centres in Raichur: An Integrated Area Development Plan for a District in Karnataka*, NICD, Hyderabad, 1974.

** Sen, Lalit K. and Siddheswar Ray, "Application of the Gravity Model for Delineating Hinterlands of Central Places in a Plain Area in India", Unpublished manuscript, 1974.

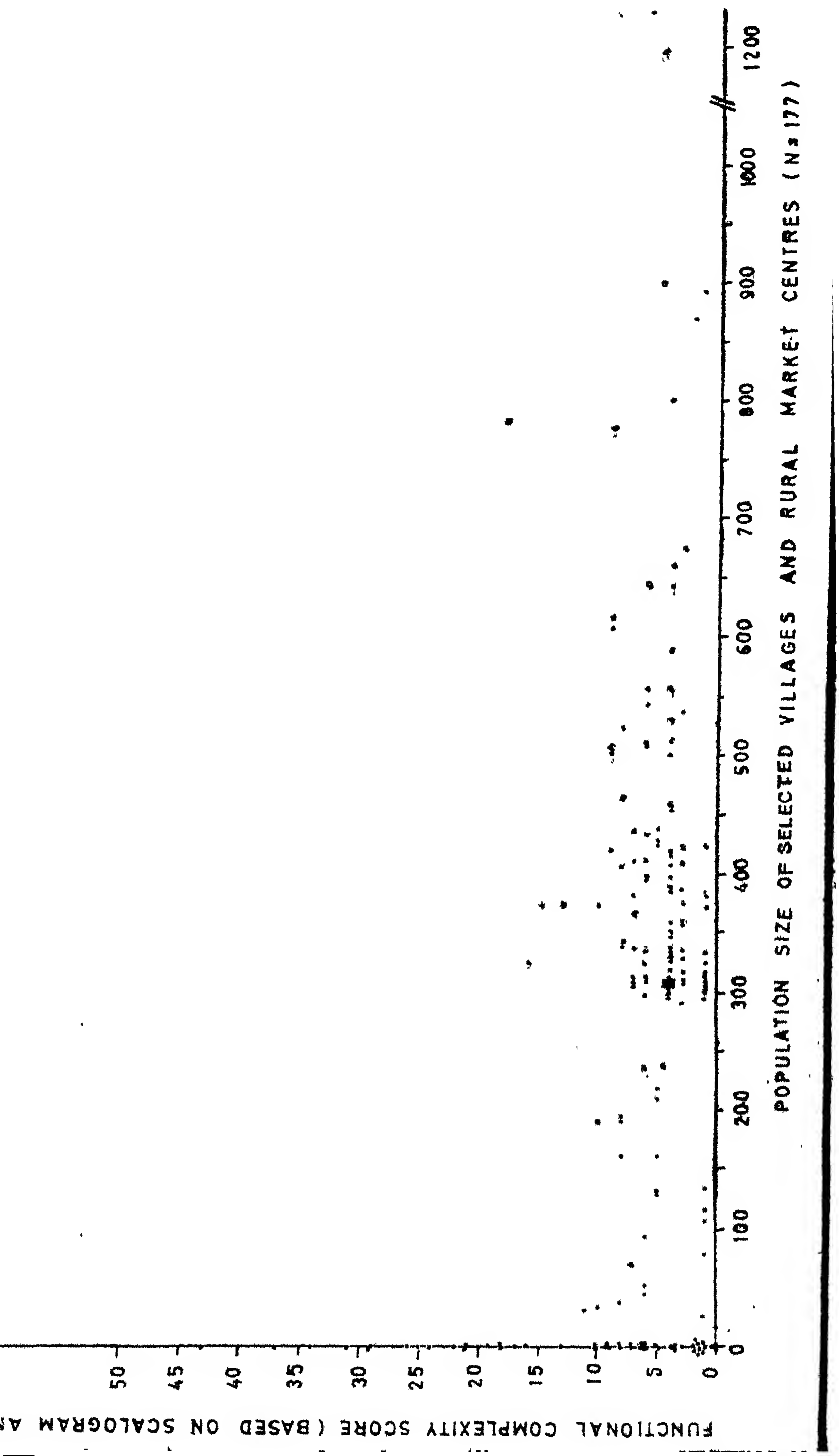


FIG. IV.2

CORRELATION BETWEEN CENTRALITY OF PLACES AND THEIR POPULATION SIZE

in a hill area. In their day-to-day movements, people in the plains select on an average the shortest route between two places. In hill areas, people select routes with the lowest gradient. Thus, a corrective to the gravity model formula incorporating a gradient quotient had to be included. With this modification, the application of the gravity model to the study area was much more in line with the empirical evidence collected from the 181 selected settlements.

Operational Steps

(*i*) *Identification of a functional hierarchy*. As explained earlier, the movement patterns of people seeking various services could only be mapped for 181 villages, towns and market centres. The ranking and grouping of functions for this analysis was made with the help of a scalogram analysis. In our earlier studies, we had used population thresholds (minimum population required to sustain a function) for identifying a functional hierarchy.* As indicated in the previous section, population has no relation to the centrality or importance of a function in the study area. This is why ranking of functions had to be done by a mathematical technique. The operational steps involved in scalogram analysis and the application of this technique to regional planning have been described in detail elsewhere.** For using this technique effectively, a few minor modifications were made in the operational procedures. For example, items with less than 20 per cent or more than 80 per cent frequency are conventionally eliminated from the scale. In our case, items or functions with less than 20 per cent frequency were retained because the scarce functions are also more highly specialized and more central than functions with higher frequency. The coefficient of reproducibility of the scale was high (C.R. = .94) showing thereby that the ranking of the functions was mathematically valid.

In all, 77 functions were included in the analysis and ranked by the scale. Three distinct breaks in the ranking emerged yielding three groups of functions arranged along a functional scale or a hierarchy. The 77 functions thus ranked are listed in Table IV.1.

TABLE IV.1 : RANKING OF FUNCTIONS AT THREE LEVELS OF FUNCTIONAL HIERARCHY

I (Lowest) Level Functions	
(1) Primary School	(2) Middle School
(3) Branch Post Office	(4) Retail Kirana Shop
(5) Blacksmith	(6) Carpenter
(7) Tailor	(8) Pan/Bidi Shop
(9) Tea/Coffee Shop	(10) Fair Price Shop
II (Middle) Level Functions	
(11) High School	(12) Intermediate College
(13) Primary Health Centre	(14) Other Health Centre
(15) Public Call Office	(16) Bus Stop
(17) Veterinary Dispensary	(18) Stockman Centre
(19) Annual fair	(20) Retail Cloth Shop
(21) General Provisions Stores	(22) Chemist and Druggist
(23) Ready-made Garments	(24) Footwear

* Sen, Lalit K. *et al., op cit.*

** Stouffer, S.A., *et al., Measurement and Prediction* (Studies in Social Psychology in World War II, Vol.4) Wiley, New York 1964; also, Sen Lalit K. *et al., Planning Rural Growth Centres for Integrated Area Development*, NICD, Hyderabad, 1971.

Table IV.1 :—(*Contd.*)

(25) Book Stall	(26) Stationery
(27) Hair-cutting Saloon	(28) Sweet Stall
(29) Meat Stall	(30) Bangle Store
(31) Fruit Stall	(32) Vegetable Shop
(33) V.L.W. Headquarters	(34) Multipurpose Cooperative Society
(35) Agricultural Extension Centre	(36) Cooperative Credit Society
III (Highest) Level Functions	
(37) Degree College	(38) Post-graduate College
(39) Civil Hospital	(40) Civil Dispensary
(41) Sub Post Office	(42) Cooperative Bank
(43) Food Grain Distributing Centre	(44) Wholesale Market
(45) Commercial Bank	(46) Veterinary Hospital
(47) Cinema	(48) Laundry
(49) Bakery	(50) Restaurant
(51) Glassware and Pottery	(52) Electrical Goods
(53) Hardware	(54) Household Utensils
(55) Bicycle Dealers' Shop	(56) Bicycle Repair
(57) Optical Shop	(58) Petrol/Diesel Pump
(59) Automobile Repair	(60) Radio Sales
(61) Radio Service	(62) Dry Cleaners
(63) Picture Framing	(64) Coal & Firewood Depot
(65) Jewellery	(66) Bedding
(67) Wine Stores	(68) Binders
(69) Printers	(70) Watch Sales
(71) Watch Service	(72) Photography
(73) Eggs & Poultry	(74) B.D.O. Headquarters
(75) Religious Institution	(76) Bus Stand
(77) Hotel	

It may be noted that there are 10 functions at the lowest level, 26 functions at the middle level and 41 functions at the highest level of the three-tier functional hierarchy. This is a clear deviance from what we have observed in our earlier studies conducted in plain areas and also from a basic postulate of the central-place theory. The frequency of functions at various levels of the functional hierarchy as observed elsewhere is highest at lowest level but gets progressively lower as the hierarchic level increases. In Pauri tehsil, this is the other way round. This is undoubtedly due to the backward conditions of the area compounded by rugged terrain and the inaccessibility of most parts of the tehsil. The lowest level or the most ubiquitous functions found in all 181 settlements are few. Higher-level functions are concentrated only in a few higher-order places which are accessible by road. It is expected, however, that with the improvement of economic conditions and of the transportation system in this area, more and more functions will appear at the lowest level.

(*ii*) *Identification of Central Places Based on People's Movement Patterns.* During the field survey, a simple question "where do you go for (a service)?" was asked of respondents in the 181 selected settlements. The responses were grouped separately for each level of functions. Functions which were available in the respondents' village or for which there was no felt need, were eliminated from the group of functions in question. If the respondents of a particular village indicated a place where they normally went for more than 50 per cent of the remaining functions, an arrow was drawn showing the movement

pattern. From the exercise, done for all 181 settlements and at all three levels of the functional hierarchy, a distinct pattern indicating all the central places and their dependent villages emerged. (Fig. IV.3, IV.5, IV.7).

(*iii*) *Application of Reilly's Law for Identifying Hinterlands of Central Plaees.* Data used for identifying central places came from only 181 settlements. If we had data from all 1392 settlements then, by drawing boundaries around dependent villages of all central places one could have easily delineated the hinterlands of these places. As explained earlier, this could not be done and a theoretical model was used instead. The model was modified in order to fit the physical characteristics of the area.

The model in its original form is known variously as the *gravity model,* the *spatial interaction model* or the *law of retail gravitation* as enunciated by W.J. Reilly and is used for finding a common point between the zones of influence of two centres at the same hierarchic level*. The model is based on the gravity principle and can be expressed in the following manner† :

$$K = \frac{d_{ij}}{1 + \sqrt{\frac{P_i}{P_j}}}$$

where K = a common point between the zones of influence of two centres, counting the distance from the centre j.

d_{ij} = distance between the two centres i and j

P_i = mass** of centre i.

P_j = mass of centre j.

The k values were found out for a pair of central places and the k points were located on map. A number of such k points between one central place (A) and others were then joined by a line on the map which produced the hinterland boundary for central place (A). The hinterland thus obtained was compared with the actual movement patterns of villagers mapped earlier. The result, however, was not satisfactory.

In order to obtain a better fit and to delineate the exact hinterland boundaries, these measures were adopted. First, we assumed that the dependency of a settlement on a central place will be governed by the distance measured along the actual line of movement

* Reilly, W.J., *The Law of Retail Gravitation,* the Knickerbocker Press, New York, 1931.

† Reilly suggested that movement between two centres would be proportional to the product of mass and inversely proportional to the square of the distance separating them. In its mathematic form it is expressed as

$$M_{ij} = \frac{P_i\, P_j}{d^2_{ij}} \quad \text{where}$$

M_{ij} is the interaction between centres i and j

P_i and P_j is a measure of mass of the two centres and

d_{ij} is a measure of the distance separating them.

** For calculating the mass of a centre, scores obtained for respective centres in the scalogram analysis were used.

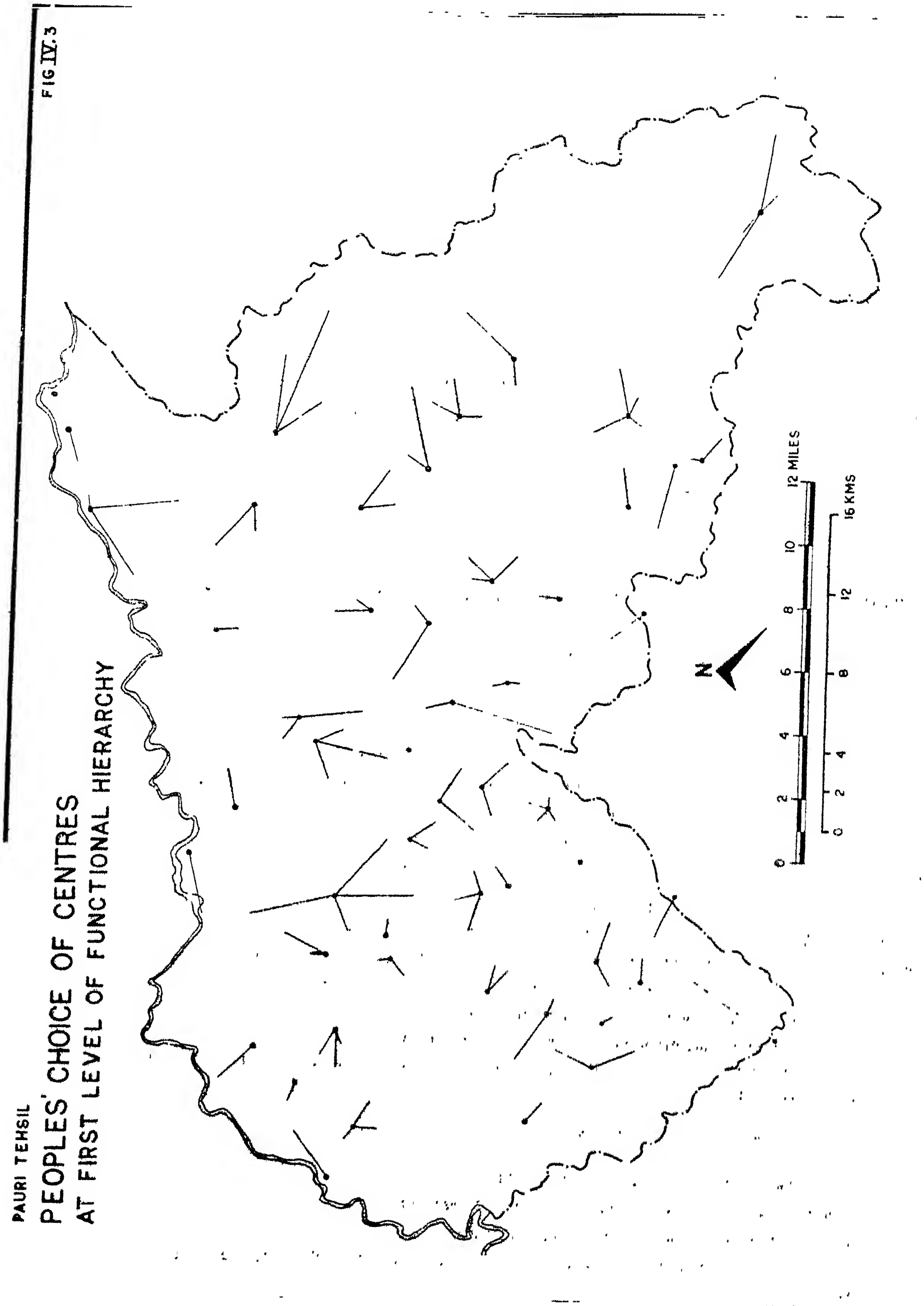


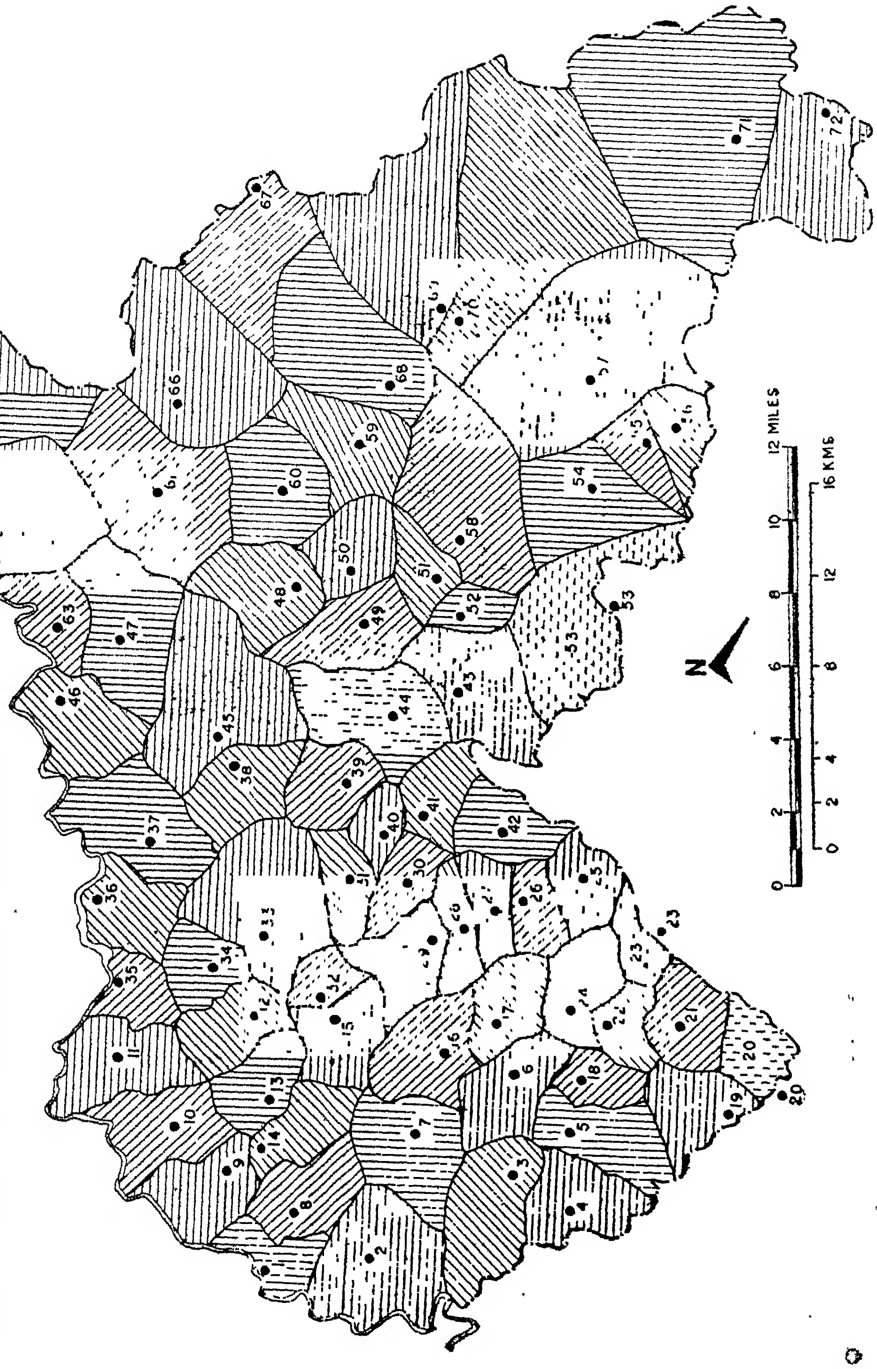
FIG IV.3
PAURI TEHSIL
PEOPLES' CHOICE OF CENTRES
AT FIRST LEVEL OF FUNCTIONAL HIERARCHY
N
12 MILES
0 2 4 6 8 10
16 KMS
0 2 4 8 12

FIG IV.4

PAURI TEHSIL

CENTRES AND THEIR HINTERLANDS

FIRST LEVEL OF FUNCTIONAL HIERARCHY



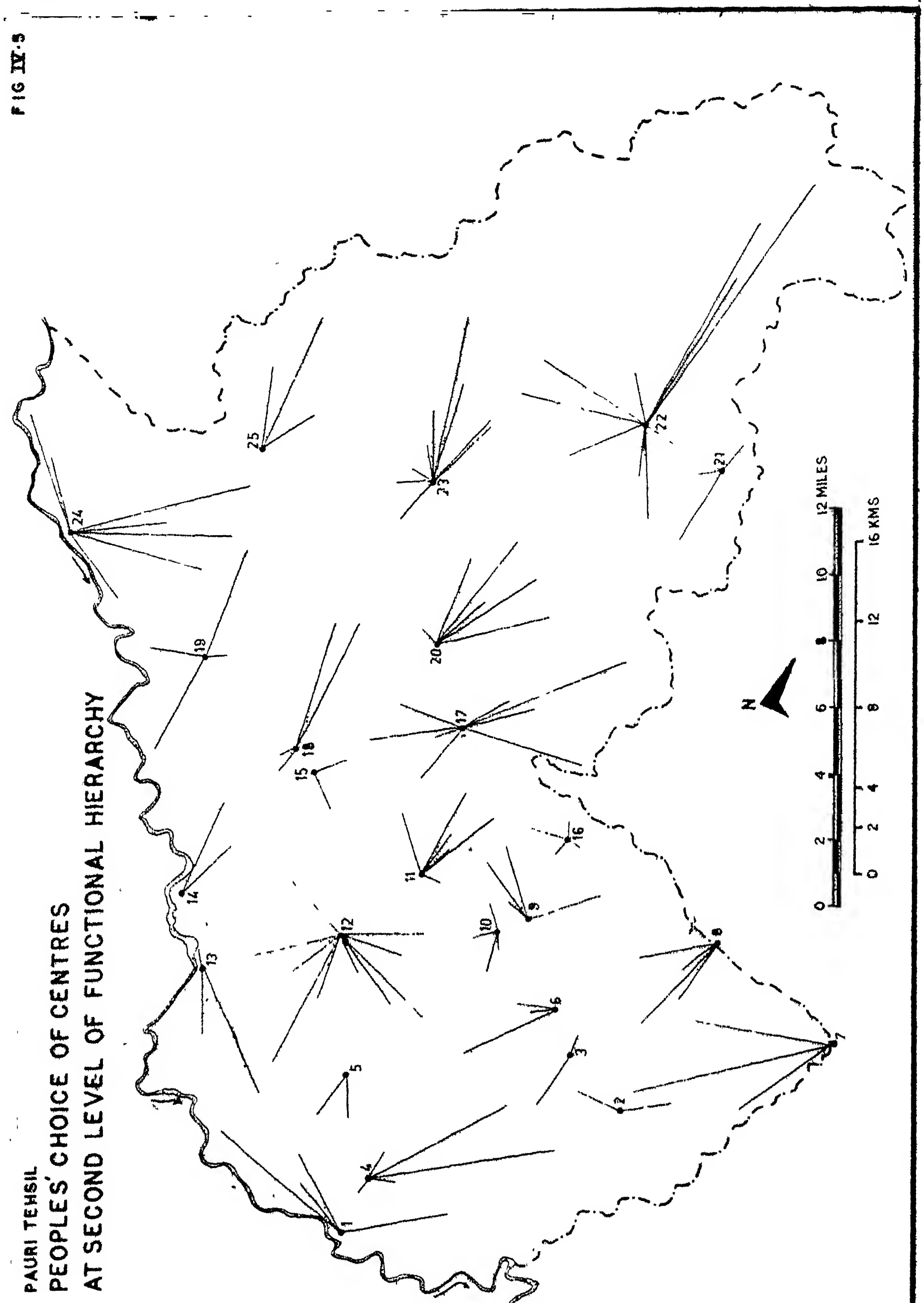


FIG IV·5
PAURI TEHSIL
PEOPLES' CHOICE OF CENTRES
AT SECOND LEVEL OF FUNCTIONAL HIERARCHY
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

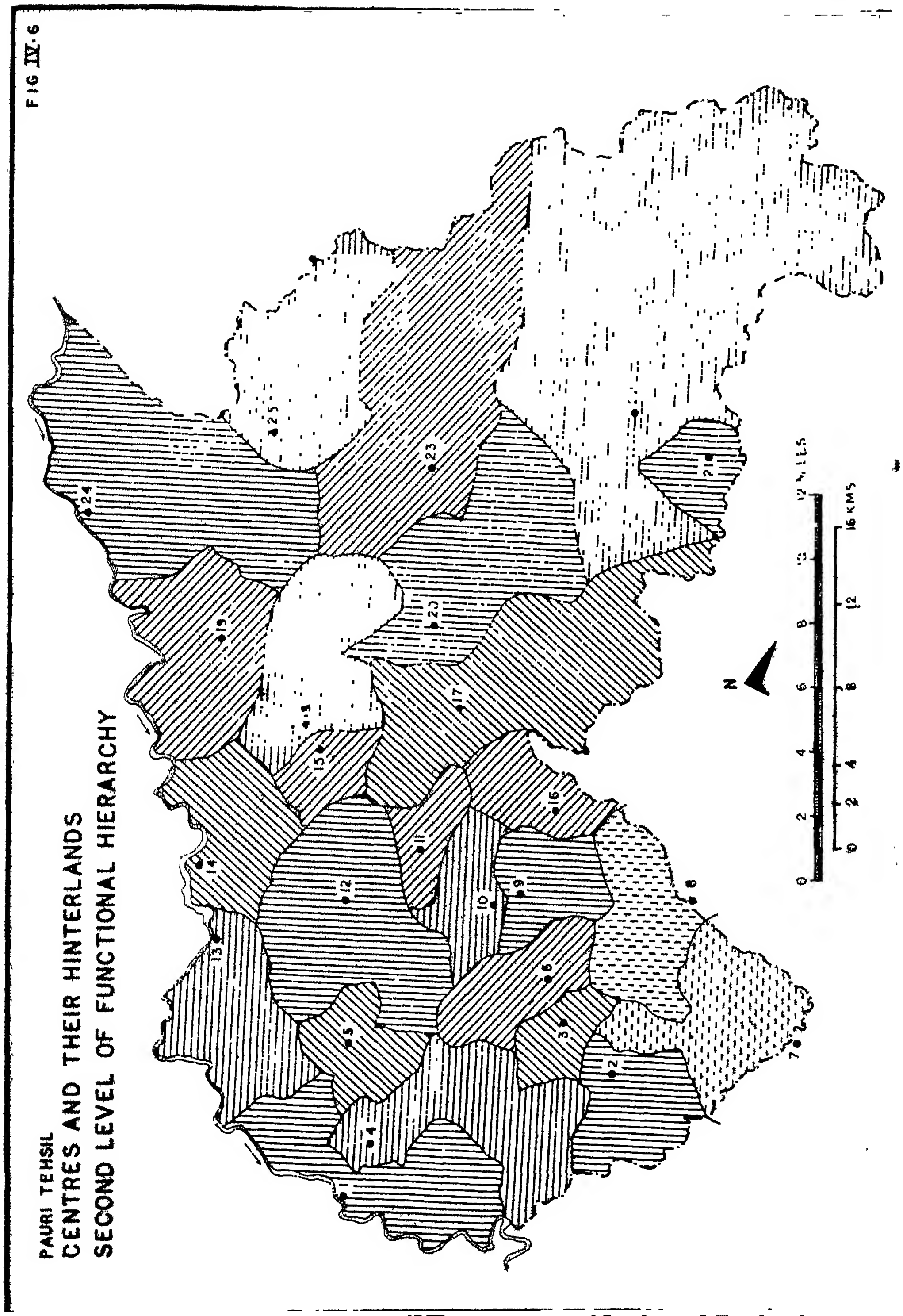


FIG IV·6

PAURI TEHSIL
CENTRES AND THEIR HINTERLANDS
SECOND LEVEL OF FUNCTIONAL HIERARCHY

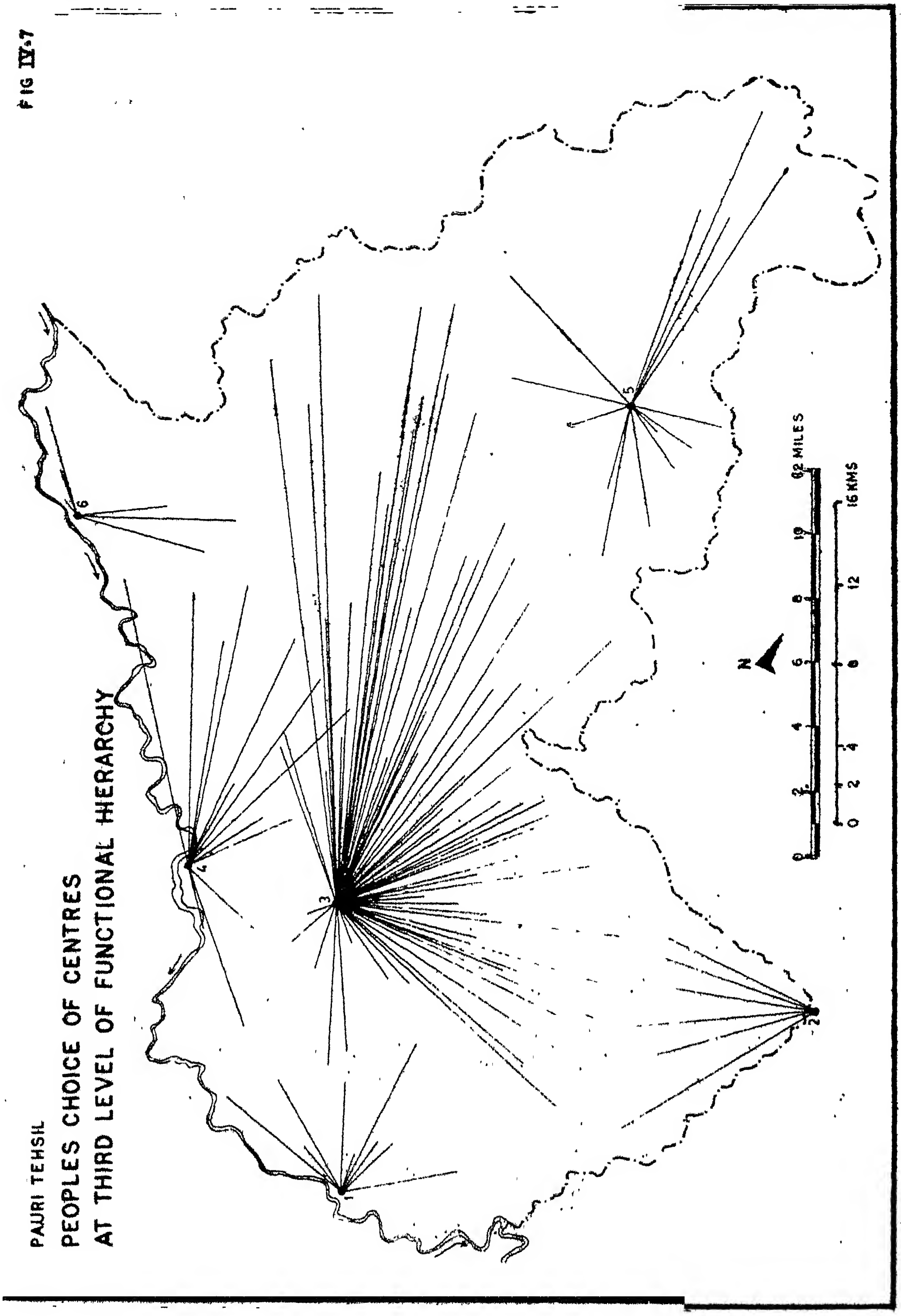


FIG IV.7
PAURI TEHSIL
PEOPLES CHOICE OF CENTRES
AT THIRD LEVEL OF FUNCTIONAL HIERARCHY
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS
1
2
3
4
5
6

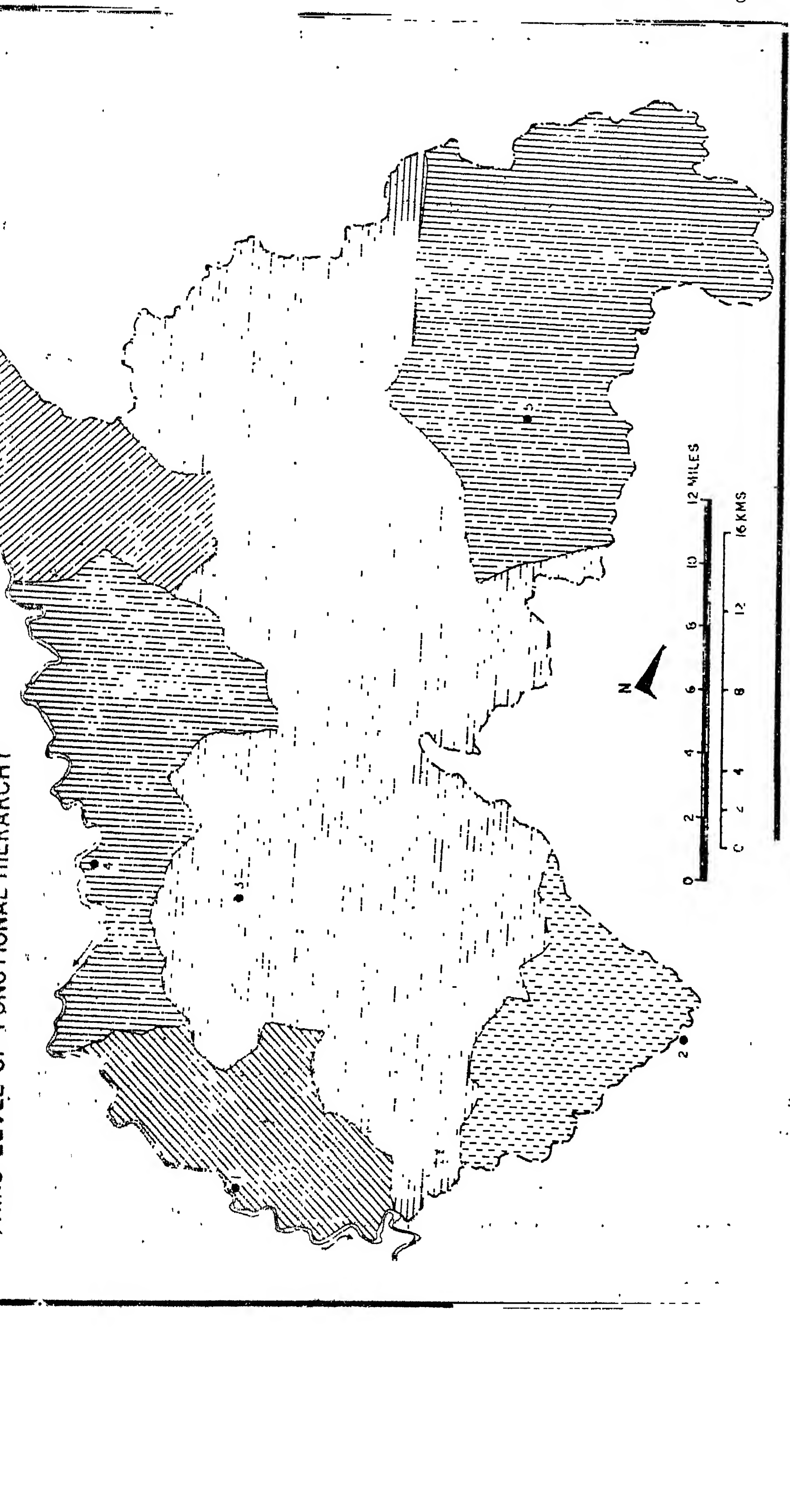


FIG IV.8

PAURI TEHSIL
CENTRES AND THEIR HINTERLANDS
THIRD LEVEL OF FUNCTIONAL HIERARCHY

irrespective of whether they travel on a road or along a foot path. So, the straight-line distance used in the former model and found satisfactory in our earlier studies, was replaced by the distance along the actual line of movement. Secondly, instead of measuring the distance between two central places, the distance between a dependent village and the nearest central place was measured. Thirdly, the gradient of the actual line of movement was taken to account. It was observed that when the distance is equal people always prefer a route which has lesser gradient as the effort required is less. This friction factor to distance was quantified by finding out the level-difference between the dependent village and the central places. With the above refinements, Reilly's model was modified as follows :

$$M_{cd} = \frac{KP_cP_d}{hD^2_{cd}}$$

where M_{cd}= interaction (dependency) between the central place c and the dependent village d.

P_c = mass of central place for which we are delineating hinterland.
P_d = mass of dependent village d for which the choice of a central place is attempted.
k = a constant of proportionality.
h = index value * for the gradient between the centres c and d.
D_{cd} = distance between centres c and d measured along the line of movement.

By using this modified model, the hinterlands were delineated in the following manner. To measure the choice of a dependent village d on two central places c and c^1 located at distances D and D^1 we measured the interactions $\frac{KP_cP_d}{h_1D^2_{cd}}$ and $\frac{KP_{c^1}\ Pd}{h_2\ D^2_{c^1d}}$ and compared the values. Since K and P_d are constants for this pair of observations, our task was reduced to finding out whether $\frac{P_c}{h_1D^2_{cd}}$ or $\frac{P_c{}^1}{h_2D^2_{c^1d}}$ was higher. If the former value was higher, then it was obvious that dependency of village d on centre c was higher. On the other hand, if the latter was higher, then d was a dependent village of centre c^1. The same analysis was carried out to find out the dependency of settlements on central places in the whole study area. This indirectly provided the exact number of dependent villages coming in the hinterland of each central place. For a few villages for which there was either the space preference data or it was obvious that it lies in the hinterland of a particular centre due to its proximity, this exercise was not necessary.

Central Places at the First (lowest) Level of Functional Hierarchy and their Hinterlands

A combination of the space preference analysis and the application of modified Reilly's formula enabled us to demarcate the hinterlands of centres at the first level. Altogether, there are 48 such centres to be called *central villages* hereafter

* The index value for the gradient was worked out taking into account are pair of central places at a time. If X_1 and X_2 are the level differences between central places C and C^1 and the dependent village d, then index value for the first centre $h_1 = \frac{X_1}{X_1+X_2}$ and for the second centre $h_2 = \frac{X_2}{X_1+X_2}$

The topography of the land in a few areas also necessitated the selection of 24 subsidiary central villages and the partitioning of the hinterlands accordingly. For example, central villages like Sabdarkhal, Kherkal and Bungidar have more than 10,000 population each in their hinterlands. The outlying villages in these clusters are about 10 km. from the central village. Given the primitive transportation facilities over a rugged terrain, some of the primary functions should be available to the villagers within a shorter distance ranges. Appropriate subsidiary centres were selected to bring this about.

In some cases, the central village was separated from some of the tributory villages by physical barriers such as rivers and hills. Tarpali and Mawdar central villages are a case in point. A scrutiny of the topography of the land showed that the construction of new bridges and roads spanning across the physical barrier in question would not be economically justifiable. Subsidiary centres for correcting this situation were chosen in such cases also.

In selecting the subsidiary centres, a few guidelines were followed. First, self-sufficient centres which had most of the first-level functions but yet had very little interaction with the surrounding villages due to lack of transportation facilities, were given preference. Appropriate road-linkages connecting the surrounding villages with the centre have been proposed in a later chapter for this purpose. Secondly, villages which had some first-level functions and showed some interaction (but not enough to be selected as central villages during the first screening) with surrounding villages were also chosen. Additional first-level functions which are currently absent from these places and appropriate road linkages wherever necessary have been recommended to strengthen these centres. Thirdly, a few strong centres which are not within the study area but just outside the tehsil boundary have been selected to serve villages located within the study area. Some of these centres are Satpuli, Patisain and Damdeval.

In all, 24 subsidiary centres were selected from the above three categories and they are listed below.

(1) Ratura, (2) Jakhati, (Tapli) (3) Chopriyun, (4) Satpuli, (5) Patisain, (6) Damdeval, (7) Samoya, (8) Gadoli, (9) Gidokhal, (10) Sankarsain, (11) Khankara, (12) Bhatisera, (13) Kirtinagar, (14) Delchaunri, (15) Kyarh, (16) Bahbazar, (17) Ghindwara, (18) Nahsain, (19) Banghat, (20) Diunsi, (21) Kandarpani, (22) Piplipani, (23) Agrora, (24) Kandara.

As a next step, the modified Reilly's model was applied on the total 72 central villages (including the 24 subsidiary central villages) for delineating the hinterlands of these central places. (Fig. IV.4)

Description of the total 72 central villages can be seen in Table IV.2.

TABLE IV.2: CENTRAL VILLAGES AND THEIR HINTERLANDS

S. No.	Name of Central Village	No. of total functions	No. of functions in 1st level	Population served	Area served in sq. km.
1	2	3	4	5	6
1.	Bahbazar	42	10	1492	15.74
2.	Ghindwara	6	6	3822	46.04
3.	Bganikhal	5	5	2748	36 69

Table IV 2 : (*Contd.*)

1	2	3	4	5	6
4.	Diusi	7	7	1531	25 47
5.	Ghandiyal	18	6	2515	27 23
6.	Kanskhet	20	8	2890	27.38
7.	Nahsain	6	5	3434	34 11
8.	Safdarkhal	22	8	3442	24 39
9.	Kamalpur	8	7	2489	24.76
10.	Jamlakhal	8	8	3017	27 33
11.	Delchaunri	8	7	4382	29 25
12.	Khandiunsain	10	10	2802	20.60
13	Kot	22	10	3644	19.25
14.	Kholchaunri	6	6	2486	18 36
15.	Lwali	11	10	2502	22.36
16.	Adhwani	6	6	1148	26.86
17.	Kalgikhal	22	9	2672	19.90
18.	Sakmikhat	7	7	1354	12.78
19.	Banghat	6	6	2296	13.30
20.	Satpuli	53	10	1650	14.99
21.	Kandarpani	7	7	3005	19 85
22.	Mawadhar	9	8	1115	13.92
23.	Patisain	24	8	1220	10.18
24.	Mundneshwar	5	5	2808	19.01
25.	Pipalipani	7	7	2158	15.40
26.	Jakheti	7.	6	2392	13.76
27.	Agrora	9	9	2057	14.28
28.	Paidul	21.	7	2067	14.62
29.	Parsundakhal	26	8	4031	22.10

Table IV.2 : *(Contd.)*

1	2	3	4	5	6
30	Kandara	7	6	2492	14.24
31.	Bubakhal	23	10	1227	18.58
32.	Daduadevi	8	8	1549	10.88
33.	Pauri	71	10	14678	48.29
34.	Kyark	5	5	2944	22.14
35.	Kirtinagar	22	10	1390	14.66
36.	Srinagar	69	10	7388	21.72
37.	Sumari	9	9	4525	39.01
38.	Chaubatiakhal	19	6	2579	25.89
39.	Chopriuni	10	10	2154	21.05
40.	Bhainswara	6	6	1554	10.54
41.	Sikukhal	10	9	2644	17.66
42	Pokhrikhet	21	10	3591	20.38
43.	Champeshwar	5	5	3233	39.31
44.	Pabau	30	10	3752	35.99
45.	Khirsu	27	8	5337	58.44
46.	Bhattisera	9	8	2707	28.13
47.	Kherkhal	20	7	5504	39.58
48.	Mailisain	5	5	2178	27.77
49.	Chifalghat	24	7	2243	29.28
50.	Sankarsain	6	5	2038	20.60
51.	Cholusain	6	6	1768	14.28
52.	Bajwar	2	2	1100	9.08
53.	Damdeval	6	5	2064	50.68
54.	Chaunrikhal	6	6	601	34.07
55.	Pokhri	10	10	1112	14.28

Table IV.2 : (*Contd.*)

1	2	3	4	5	6
56.	Bhira	14	7	1454	15 14
57.	Thailısain	26	7	5263	102 68
58.	Nautha	5	5	2779	98 13
59.	Chakisain	13	7	2715	30.75
60.	Paithanı	6	6	3190	31 52
61.	Barsurı	7	7	4287	58.81
62.	Rudraprayag	51	10	4565	50 23
63.	Khankara	10	10	1128	24.04
64.	Sumerpur	5	5	697	23.19
65.	Ratura	10	10	2594	28 58
66.	Molkakhal	13	6	2364	62.05
67.	Gidokhal	4	4	602	40 43
68.	Chaunra	5	5	4187	50.61
69.	Gadolı	8	8	2764	71.53
70.	Tarpali	6	6	1091	10.89
71.	Bungidhar	8	8	5992	120.99
72.	Samoya	5	5	2022	39.46

Central Places at the Second (Middle) Level of Functional Hierarchy and their Hinterlands

At the second level of functional hierarchy, there are 26 functions. The same procedure as adopted in identifying central places in the first level was used to identify the central places at this level. Altogether, 25 centres emerged as central places. Among these centres, four were subsidiary centres chosen while realigning the hinterland boundaries for first-order settlements. In addition to Satpuli and Patisain which are located outside the tehsil, Bahbazar and Kirtinagar fall under this category. For the purpose of this report, we have called these centres *service centres*. (Fig. IV.6)

The delineation of hinterland for these centres was simpler compared with the exercise done for the first-level centres. Here the pattern of spatial interaction (see Fig. IV.5) clearly indicated the people's preference for central places. The space preference data on people's movements were found quite sufficient to demarcate the hinterland and Reilly's

model was not applied. Service centres, their functions, and populations and hinterlands served by them are shown in Table IV.3.

TABLE IV.3: SERVICE CENTRES AND THEIR HINTERLANDS

S. No.	Name of Centre	No. of total functions	No. of 2nd level functions	Population served	Area served in sq. km.
1	2	3	4	5	6
1.	Bahbazar	42	22	7803	86.54
2.	Gandiyal	18	12	4046	52.70
3.	Kanskhet	20	12	2890	27.38
4.	Safdarkhal	22	14	9624	95.15
5	Kot	22	12	6130	37.64
6.	Kaljikhal	22	13	3820	46.76
7.	Satpuli	53	21	8305	70.92
8.	Patisain	24	16	7301	58.51
9.	Paidul	21	14	6517	42.66
10.	Parsundakhal	26	18	6523	36.34
11.	Bubakhal	23	13	2781	29.12
12.	Pauri	71	25	24475	151.60
13.	Kirtinagar	22	12	8789	43.91
14.	Srinagar	69	24	11913	60.73
15.	Chaubatikhal	19	13	2579	25.89
16.	Pokhrikhet	21	11	6235	38.04
17	Pabau	30	20	12303	156.11
18.	Khrisu	27	19	7515	86.21
19.	Kherakhal	20	13	9339	91.75
20.	Chifalghat	24	17	8828	162.29
21.	Bhira	14	7	2566	29.42
22.	Thailisain	26	14	14969	308.09
23.	Chakisain	13	6	12856	184.41
24.	Rudraprayag	51	20	12143	160.81
25.	Molkakhal	13	7	2966	102.48

Central Places at the Third (Highest) Level of Functional Hierarchy and their Hinterlands

To identify the central places at this level and to delineate their hinterlands, the same method as in the case of the second-order centres was adopted. Six centres emerged as central places at this level. They are Pauri, Srinagar and Bahbazar, all urban centres, and three non-urban centres namely, Thailisain, Satpuli and Rudraprayag. We have called these centres *as growth centres* at this level. Table IV.4 describes the number of functions, population and area served by these *growth centres* (Fig. IV.8).

TABLE IV 4 : GROWTH CENTRES AND THEIR HINTERLANDS

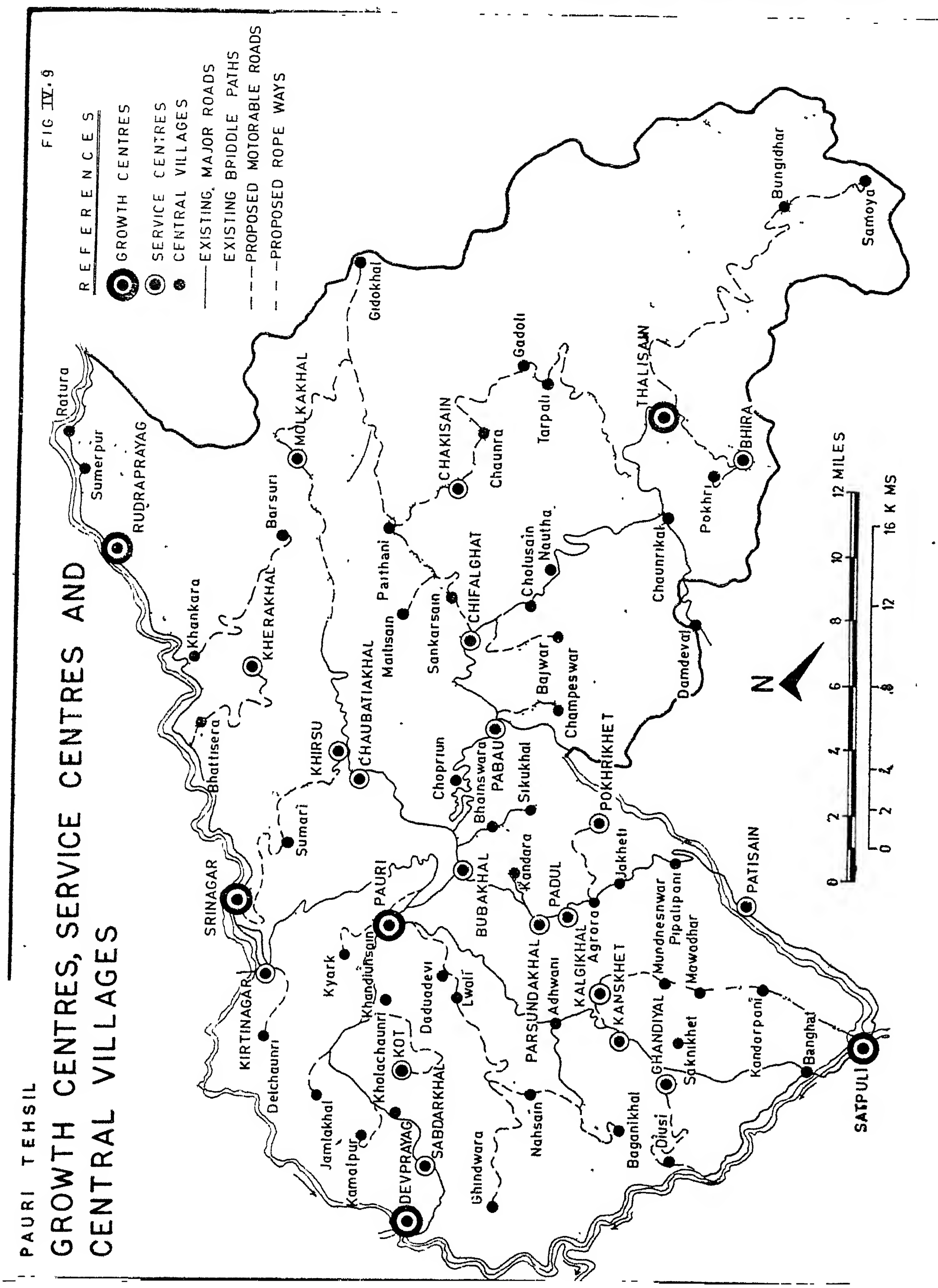
S. No.	Name of the Centre	No of total functions	No. of III level functions	Population served	Area served in sq. km.
1	2	3	4	5	6
1.	Bahbazar	42	10	16748	156 62
2.	Satpuli	53	22	14686	147.72
3.	Pauri	71	36	110303	1127 98
4.	Srinagar	69	35	32361	254 83
5.	Thailisain	26	5	17535	337.51
6.	Rudraprayag	51	21	12143	160.81

Among these growth centres, Pauri town occupies a dominant position and has a hinterland covering more than 50 per cent of the total geographical area of the tehsil and serves more than 50 per cent of the tehsil's population. Srinagar is placed second although the size of its hinterland is smaller than that of Thailisain. The position of Thailisain is unique in the tehsil. The census does not classify it as 'urban', yet it serves a large hinterland and population. It is quite striking that Thailisain in spite of its meagre five functions in the third-order serves an area of 337.51 sq.km. whereas Srinagar town with its 36 functions serves only an area of 254.83 sq.km. This illustrates the importance of the geographical location of Tahilisain as compared with the other urban centres. (Fig. IV.9).

Planning Implications

In the previous sections, we have described the methods by which growth centres, service centres, central villages and their respective hinterlands have been identified. The purpose of this chapter was to (1) delineate basic planning units and (2) to identify settlements in these units for locating new investments in agricultural infrastructure, industries and social facilities. We have accomplished both these tasks.

The smallest planning unit consists of the central village and its hinterland. Further, along the hierarchy of settlements, the service centres and growth centres, being more central in character, have larger hinterlands. The units consisting of the central places and their hinterlands at the three hierarchic levels are the basic planning units we had set



PAURI TEHSIL
GROWTH CENTRES, SERVICE CENTRES AND CENTRAL VILLAGES

out to discover. As they are on different scales, the three units also indicate the nature of investments that can be put in them.

The smallest unit, the central village hinterland, provides a framework for designing agricultural infrastructure and social facilities. The average farmer will travel only short distances for buying agricultural inputs and selling his farm produce. Similarly, children can only travel short distances to go to school and the sick needs medical facilities within easy reach of his village. The first-level units provide the optimum territorial expanse for these purposes. It may be underlined again that these units were partly delineated on the basis of actual movement patterns of the people for services of this order. The central villages provide the actual locations for new investments. As the dependent villages are already linked with their central villages, planning new investments in the central villages will strengthen the spatial linkages which already exist. As indicated earlier, the lowest level planning unit consisting of a few dependent villages and their central village has been utilized in this study for the planning of agricultural infrastructure and social facilities. The unit has been called a "cluster" in later chapters.

The two major projections done in this study namely, projection of agricultural production and population projection, have also been made on the basis of these "clusters" instead of villages. For the purpose of this study, the "clusters" are perhaps the most important and consequently the most basic planning units in the district. It may be noted again that the size and area of the basic planning unit varies directly with the level of development in the area. The less developed an area, the smaller are the units.

For industrial planning, however, the unit has to be enlarged. Here the focus is on the service centre, growth centre and their hinterlands. For economic viability, an industrial plant must have a larger hinterland for obtaining basic raw materials. A cluster, as has been defined in this report, may not be large enough to provide sufficient raw materials to an industrial plant.

In area planning, therefore, there is no single unit of planning. The unit to be selected will depend entirely on the sector of planning and on the magnitude of investment. In backward areas, where even the basic infrastructure is absent, the smallest unit, the "cluster", will provide the most important base for planning.

It needs to be emphasized again that with the progress of development, the planning units will also become larger. Since development is a dynamic process, the settlement patterns and their inter-linkages are also expected to be transformed continuously. What we have proposed in this study is based on the existing situation in the study area. Some of our recommendations are in the nature of corrective measures for streamlining the existing relationships. If and when the plan recommendations are implemented, it is quite likely that the very fact of plan implementation will change the basic settlement structure in the study area. It is necessary, therefore, to review and evaluate the system of settlement inter-linkages every five or ten years. It is recommended that at the end of this period, a fresh look should be taken at the study area and the plans presented in the following chapters should also be revised in the light of the changes that might have taken place during the next few years.

CHAPTER V

PLANNING FOR AGRICULTURAL DEVELOPMENT

The present agricultural production in Pauri tehsil falls short by about 50 per cent of the tehsil's food requirements. A large quantity is being imported from outside bearing a heavy transportation cost. The inherent topographical features of this hilly area seriously impede the establishment of a smooth transportation and distribution system for carrying foodgrains to every settlement in the tehsil. It is much more realistic to explore the possibility of improving food production in the tehsil itself.

The need for urgent planning in agriculture also stems from the fact that only 19.63 per cent of the total geographical area of the tehsil provides employment to 84 per cent of its population. While the net sown area shows only marginal increase from 17.40 per cent in 1971 to 19.63 per cent in 1973, the pressure on agricultural lands keeps mounting every year due to population increase and also due to lack of alternative employment opportunities. The cultivated area with only 2.49 per cent of its land irrigated, is unable to support its present population. Aside from the general backwardness of this area, the inherent difficulties of a hilly area have undoubtedly contributed to this acute imbalance. It is still necessary, however, to explore the latent agricultural potentiality of this area which may have remained untapped and make recommendations for its maximum utilization. This has been done in this chapter.

It should also be pointed out here that the success of the agricultural development programmes recommended in this chapter will depend a great deal on the simultaneous development of other land and animal-based activities such as horticulture, sericulture, forestry and animal husbandry. As mentioned in Chapter III, these activities should provide more promising and profitable avenues of work to the local people than their depending solely on agriculture. The diversion of manpower from agriculture would reduce the pressure on agricultural land to a great extent and would also raise the level of income in the tehsil. Recommendations for the development of these activities have been made in other chapters in this report.

Approach to Agricultural Planning

The objective of this chapter is to frame guidelines for the exploitation of agricultural potential to expand, stabilize and diversify agriculture in order to meet the requirements of the area to the maximum possible extent. In order to achieve this objective, a rational approach to agricultural planning would be to:

(*i*) assess the present state of agriculture in the tehsil;
(*ii*) identify agricultural problems and problem areas which need solution;
(*iii*) identify potential agricultural land;
(*iv*) assess irrigation potentialities;
(*v*) evolve a rational cropping pattern;
(*vi*) work out a suitable crop rotation system;
(*vii*) suggest effective soil conservation measures; and
(*viii*) project future agricultural production based on the above recommendations.

Assessment of the Present State of Agriculture

As regards the present state of agriculture in the tehsil, we find that in 1973, out of a total geographical area of 2,21,100 hectares only 43,403 hectares (19.63 per cent) have been put to agriculture. The comparative figure for the State of Uttar Pradesh is 55 per cent. The factors which account for this low percentage of agricultural area are many. The tehsil is hilly in nature with steep slopes over a large portion of its area. These slopes are susceptible to gully erosion and are also subject to land-sliding. Moreover, steep slopes facilitate rain water to run off quickly before it percolates in sufficient quantity in the sub-soil. Consequently, the latter lacks in moisture. Heavy rain in the tehsil (average rainfall 60.5″) gets accelerated in velocity on steep slopes and washes off the soil leaving only a thin vaneer. In slopes the soil is also sandy in nature which does not have sufficient moisture retentive capacity. These unfavourable geographical factors have made agriculture a risky, difficult and expensive occupation in the tehsil. This has bearing not only on the total agricultural area of the tehsil but also on the size of holding and nature of farming. Because of mountainous topography. terraced farms are the rule. The farm size is very small in area ranging from 0.1 to 0.75 acre whereas the average is 5.3 acres for the state.

Spatial Distribution of Agricultural Land

The spatial distribution of agricultural land is very uneven in the study area. About 70 per cent of the agricultural land is concentrated in the western half of the tehsil whereas the eastern half accounts for only 30 per cent. This disparity in the distribution of agricultural land becomes more pronounced when we go down to the *cluster* level. The maximum concentration of the net sown area is in Ghindwara cluster where it is 1,722 hectares constituting 37.4 per cent of the total geographical area of the cluster. The minimum area under agriculture in the tehsil has been reported in Gidokhal cluster with 80 hectares of net sown area (2 per cent of total area).

Per capita Agricultural Land

The average per capita net sown area in the tehsil is only 0.21 hectares as against 0.54 hectares for the state. It indicates that the per unit agricultural land in the tehsil is supporting a much larger population than that of the state. The per capita agricultural land differs in different parts of the tehsil (Table V.1).

TABLE V.1 : PER CAPITA NET SOWN AREA IN PAURI TEHSIL, 1971

S. No.	Name of block	Per capita net sown area in hectares
1.	Thailisain	0.32
2.	Khirsu	0.14
3.	Kot	0.35
4.	Kaljikhal	0.22
5.	Pauri	0.17
6.	Pabau	0.18
7.	Pauri tehsil	0.21
8.	U.P.	0.54

The per capita net sown area is the highest in Kot block (0.35 h) followed by Thailisain (0.32 h). The corresponding figures for the rest of the blocks are less than the average for the tehsil. Khirsu block has the lowest per capita net sown area in the tehsil, only 0.14 hectare.

Double-cropped Area

At present 21,345 hectares of land are under double cropping in the tehsil. This forms 49 2 per cent of the total net sown area. Compared with the state's double-cropped area of 27 per cent, the tehsil's performance on the surface looks good. However, when the double-cropped area of the tehsil is seen in relation to its total geographical area, it comes only to 9 per cent which is very low. Also, the actual production of the second crop is poor. The percentage of double-cropped area to net sown area in different parts of the tehsil varies. In Chakisain cluster 66.2 per cent of the net sown area is under double cropping which is the highest in the tehsil. The lowest percentage is in Kandarpani (32.2 per cent). In terms of the area under double cropping, Bungidhar cluster with 681.51 hectares comes first. The smallest area under double cropping, 44.42 hectares, is in Gidokhal.

The total gross cultivated land in the tehsil, counting double-cropped areas also, is 64,748 hectares. Thus, the availability of per capita agricultural land is raised to 0.32 hectares which is still very low.

Fallow Land

The fallow land in the tehsil (including current as well as other fallow land) is to the extent of 11,740 hectares. This constitutes 5.15 per cent of the total geographical area of the tehsil. If these fallow lands can be put to agriculture again, the net sown area will be increased to 54,873 hectares. Thus, 24.80 per cent of the total geographical area can be under agriculture. The possible increase in net sown area by extending it to fallow lands will not, however, be uniform throughout the tehsil as there is great disparity in the availability of fallow land in the study area. For example, in Sumari cluster the fallow land is as large as 564 42 hectares (which is more than 60 per cent of the net sown area of the cluster). In Sikukhal cluster there is only 10.04 hectares of fallow land constituting 2 per cent of its net sown area. Eventhough the area of fallow land differs from place to place, almost all the clusters have some fallow areas. If these fallow lands are reclaimed, a small increase in the net sown area can be brought about. This small increase is not going to make a substantial difference, however, and a systematic investigation is needed for identifying additional potential agricultural areas.

Irrigation

As mentioned earlier, in Pauri tehsil only 2.49 per cent of the agricultural area is irrigated indicating thereby that crops are mostly rainfed. Rains in Pauri tehsil are concentrated during the four months, June to September, and, therefore, agriculture is mostly confined to the kharif season. In the rabi season, the farmers take chances and put 49.2 per cent of the net sown area under a second crop. This large area under double cropping is misleading as the actual area is small and the productivity of the second crop extremely low due to uncertain rainfall and poor fertility of the land. Often, because of long breaks in the monsoon, even in the kharif season paddy has to depend on irrigation. Even during a normal kharif season, the available rainfall (after excluding the run-off water) is not enough

for some of the major crops although the average annual rainfall in the tehsil is quite high (60.5″). Water requirement for different crops has been listed in Table V.2

TABLE V.2 · WATER REQUIREMENT OF DIFFERENT CROPS

Crop	Period	No. of days	Water requirement cm.	Available rainwater in cm.	Surplus/ deficit cm.
Paddy (Hybrid)	June—Nov.	150	150 00	110 20	—39 8
Paddy	Feb.—May	120	120 00	17 60	—102 4
Wheat	Nov.—March	160	40 00	20.97	—19 03
Barley	Nov.—March	150	30.00	20 97	—9 03
Mandua	June—Sept.	120	30.00	101.86	+7 18
Jhangora	June—Sept.	120	30.00	101.86	+7.18

From Table V.2 it can be seen that for Mandua and Jhangora the rainfall is more than their requirement. Paddy has the maximum deficiency of water followed by wheat. For Barley, additional water requirement is very low, *i.e.*, 9.03 cm.

It should be clear from the preceding discussion that there is a great need for irrigation in the tehsil. There are obvious reasons, of course, why irrigation is practically non-existent in the tehsil. First, the hilly nature of the tehsil often stands in the way of constructing canals. Well irrigation is also unsuitable for the area. Secondly, the backwardness and the poor economic conditions of the area precluded any mobilization of resources for this purpose. A few irrigation schemes have, however, been proposed in the Fifth Five-year Plan and it is hoped that a substantial area could be brought under irrigation during the next few years.

Irrigation Schemes

With the completion of the First, Second and the Third Five-year Plans, 837 hectares of agricultural land was brought under irrigation. Canals were the only source of irrigation. In the Fourth Five-year Plan, a number of irrigation schemes were also proposed. These were also canal irrigation schemes. The total length of canals proposed for the Fourth Plan was 26.30 km. with a command area of 242 hectares. The schemes included in the Fifth Five-year Plan are as under.

1. *Hilly canals.* The hilly canals have been proposed in those locations where water is available in small ditches throughout the year and the area is suitable for irrigation. So far, all the hilly canals have been taken away from such ditches only. During rainy season the storm water flows into these depressions and except for a few months in summer there is enough water for irrigation. From these sources sufficient water is made available for paddy as well as for a second crop of wheat. For canals proposed in the Fifth Plan, only preliminary surveys have been conducted. Detailed surveys have yet to be made. According to these proposed schemes, an additional area of 324 hectares can be brought under irrigation. These schemes will be taken up at different locations in the tehsil as has been shown in Table. V.3.

TABLE V.3 : PROPOSED SCHEMES FOR PAURI TEHSIL IN THE FIFTH FIVE-YEAR PLAN—GRAVITY CHANNELS

S. No.	Name of the scheme	Length in km.	Command area hectares
1.	Bhatti Sera	1.00	8 00
2.	Chapra Digoli	3.50	20.00
3.	Kuber Sera	1.00	8.00
4.	Gostu	1.60	12.00
5.	Jagri Ratura	4.00	60 00
6.	Sumerpur	1.50	16.00
7.	Dumgri	3.00	24 00
8.	Kalna	2 00	16.00
9.	Maugaon Chaluni	2 50	20.00
10.	Pokhri Gangan	7.00	30.00
11.	Chaunra	5.00	30.00
12.	Mason	4 00	20.00
13.	Ithur	2.50	16.00
14.	Pabau	4.00	16.00
15.	Kalasu	3 50	28.00
	Total	46 00	324.00

2. *Lift irrigation schemes*. In addition to canal irrigation (gravity flow), a number of lift irrigation schemes have also been proposed in the Fifth Five-year Plan. This will be the first attempt of its kind in the tehsil and will be extremely beneficial for this hilly area. There are agricultural lands which do not get the benefit of their proximity to big rivers as the elevation of these lands is too high. With the help of lift irrigation, water can be lifted by electric pumps to a height of 500 feet from the source of water. In the Fifth Five-year Plan, proposals for lift irrigation schemes along river Alaknanda and Nayar have been made. In order to implement these schemes, electrification of these areas will be necessary. The proposed irrigation schemes in the tehsil have been listed in Table V.4.

TABLE V.4 : PROPOSED LIFT IRRIGATION SCHEMES FOR PAURI TEHSIL IN THE FIFTH FIVE-YEAR PLAN

S. No.	Name of scheme	Source (Name of River)	Irrigated area in hectares
1.	Srikot Gagnall	Alaknanda	60.00
2.	Koteshwar	,,	30.00
3.	Nakot	,,	40.00
4.	Janasa	,,	60.00
5.	Sarasu	,,	80.00
6.	Jyudiliya	Devalgarh	60.00
7.	Barat Malla	,,	50.00
8.	Muchyali	Alaknanda	150.00
9.	Kammand	Kammand	60.00
10.	Bilkhet	Nayar	100.00
11.	Chamelisain	,,	40.00
		Total	730.00

The total area which will be irrigated by these schemes is 730 hectares.

Besides these two types of irrigation, no other scheme like hydram or tubewell has been proposed for this tehsil.

When all these schemes are completed, the total irrigated area of the tehsil will be 2,106 hectares, about 5 per cent of the total agricultural area.

Sources of Irrigation

From the foregoing discussion it is clear that canals are the most important source of irrigation in the tehsil. These sources are not distributed uniformly throughout the tehsil but are rather confined to the north-west and south-east part of the study area along the river basins. Canals are perennial in nature which facilitate the growth of double crops. These canals vary in length ranging from 1 to 4 km. The command area of various canals also varies according to the length of the canal, quantity of water and the nature of the terrain. In most cases, area irrigated by this means is 8 to 40 hectares.

A low percentage of area is also irrigated by springs. This is the only source of tapping ground-water for irrigation. These are distributed all over the tehsil, being governed by the geology of the area. Area irrigated by this source has not been recorded so far. The area of agricultural land irrigated by the above two sources is too meagre and cannot be depended upon for an intensive agricultural development programme.

Cropping Pattern

There are five major crops in the tehsil which occupy about 92 per cent of the total cultivated land. These are paddy, wheat, barley, mandua and jhangora. Among other crops, pulses, vegetables, tobacco and oilseeds are important. Mandua is the most important crop and it is grown in 29 per cent of the total cultivated land. With a few exceptions, this is the predominant crop in most of the clusters of the tehsil. This is a substitute for wheat and is grown on uplands under rainfed conditions.

Nearly 23 per cent of the total cultivated land is under wheat. Generally areas of deep soil which has high moisture retentive capacity have been given to this crop. Rainfall in the area is not sufficient for wheat and wherever possible it is grown with the help of irrigation.

Paddy also accounts for 23 per cent of the total cultivated land. Eventhough the crop is adaptable to a variety of environmental conditions, mostly valleys and areas of fertile soil have been given to this crop. Since the water requirement of paddy is high compared with other crops, 95 per cent of the irrigated lands are paddy farms.

Jhangora is a substitute for paddy. It occupies 9 per cent of the cultivated land. Areas which are not suitable for paddy are given to this crop. It is mostly grown on uplands under rainfed conditions.

Nearly 8 per cent of the area is under Barley. Eventhough the available rainwater falls short of the actual water requirement of this crop, it is seldom irrigated (see Table V.2).

Vegetables and other cash crops occupy very little area (8 per cent) mostly on fertile soil. These crops are also grown with the help of irrigation.

Crop Rotation System

On the basis of the prevalent crop rotation system, 49.2 per cent of the net sown area is under a second crop. The present crop rotation is as follows:

1. Paddy — Wheat
2. Mandua — Fallow
3. Jhangora — Barley

There is very little difference in the area under paddy and wheat which indicates that as a rule wheat is the second crop in all paddy farms. Since the fertile and moist areas like valleys and irrigated areas are given to paddy, wheat is the most suitable second crop to be grown on this land. On uplands mandua is the first crop and then it is left fallow in order to retain moisture for cultivating paddy in the succeeding year. Jhangora is grown as kharif crop on lands which are not fit for paddy cultivation. This is followed by barley as a second crop as its water requirements are less than wheat (Table V.2). Vegetables and pulses are grown both as kharif and rabi crops.

Production and Consumption of Agricultural Produce

As far as production is concerned, paddy is the most important crop in the tehsil. It accounts for 39 per cent of the total agricultural produce. Wheat comes next to paddy as it contributes 24 per cent of the total production. Although mandua occupies the largest area, its share is only 21 per cent of the total production. Barley contributes 8.6 per cent to the total produce whereas jhangora contributes only 6.8 per cent.

The consumption figures of different crops are based on our primary survey. It was found that the per capita and per family requirements of food crops differ for different categories of people as has been shown in Table V.5.

TABLE V 5 : PER CAPITA ANNUAL CONSUMPTION OF FOOD CROPS—1973

S. No.	Consumer categories	Consumption (in kilograms)					
		Rice	Wheat	Small millets	Barley	Pulses	Total
1.	Cultivators	80.64	87.72	39.00	5.64	16.20	229.20
2.	Landless farmers	58.40	58 77	49 28	9.49	18.25	194.19
3.	Artisans	77.75	93.08	34.31	5.48	15.70	226.32
4.	Others	72.26	79.85	40 86	6.83	16.71	218.51

By using the above norms, the total food requirement for each cluster for the year 1973 was worked out. Seed requirements were also calculated for different clusters. These two figures were added up to get the total requirement of different crops in the clusters (Appendix V.1). These consumption figures were then compared with the actual production of different crops in each cluster in order to understand the food position in these areas (Appendix V.1). These figures were added up for the tehsil to get the total picture. (Table V.6.)

The data in Table V.6 indicates that the food position in the tehsil is far from satisfactory. There is considerable shortage of rice and wheat which are used as staples in the tehsil. The total production of six major foodgrains in the tehsil is 26,690 tonnes whereas the requirement is 46,470 tonnes. Even at the cluster level, the picture is the same with a few rare exceptions. The maximum shortage recorded in 1973 was that of rice followed by wheat and pulses. Mandua, jhangora and barley show only marginal surpluses.

TABLE V 6 : PRODUCTION AND CONSUMPTION OF FOOD CROPS IN PAURI TEHSIL, 1973 (*in tonnes*)

S. No.	Name of crop	Production	Consumption	Surplus/Deficit
1.	Rice	6,200	16,310	—10,110
2.	Wheat	7 630	17,810	—10,180
3.	Barley	1,960	1,150	+ 810
4.	Mandua	7,430	6,040	+ 1,390
5.	Jhangora	2,440	1,880	+ 560
6.	Pulses	1,030	3,280	—2,250
	Total	26,690	46,470	—19,780

Problems of Agriculture

The foregoing assessment reveals that the present state of agriculture is far from satisfactory in the tehsil. There are several problems which are responsible for this state of affairs. In order to make any development plan for agriculture in the tehsil, it is necessary to have a better understanding of these problems which need to be solved in a rational way. These problems are as under.

1. *Low extent of agricultural land.* We have seen earlier that only 19.63 per cent of the total geographical area is under agriculture with a per capita holding of only 0.21 hectares. This figure is too low and in no case sufficient to feed the depending population under conditions prevalent in Pauri. Under existing conditions, there is little scope for expanding the agricultural area to any significant extent as the fallow land is also only of the order of 5.14 per cent of the total area. The scope for the second alternative of bringing more areas under double cropping also seems limited as the topography, soil fertility and irrigation facilities are not in favour of it. In short, only a marginal increase can be brought about in the existing agricultural area unless new areas are opened up with the help of vigorous soil conservation programmes and new irrigation schemes.

2. *High pressure on agricultural land.* Eventhough only 19.63 per cent of the total area is under agriculture, it is providing employment to 84 per cent of the total working population of the tehsil. This reveals the magnitude of the pressure which is exerted on the cultivated land. The annual increase in population without a corresponding increase in the agricultural area, is accentuating this imbalance even further. This phenomenon has direct bearing on the level of development of the tehsil and calls for immediate steps for its solution.

3. *Inadequate irrigation facilities.* There is remarkable difference in the per-acre yield of crops especially paddy and wheat under rainfed and irrigated conditions. We have noted earlier that only 2.49 per cent of the total agricultural area is irrigated. This low level of irrigation not only affects the productivity of a particular crop but also determines the cropping pattern. Areas which could have been given to double cropping are now lying fallow in the absence of irrigation facilities. Thus the gross cultivated area is lower than what it should have been with the availability of irrigation. Besides, on uplands,

where valuable crops like paddy and wheat can be grown with irrigation, are currently under mandua and jhangora. These crops are also poor in per-acre yield. Thus inadequacy of irrigation has brought down the productivity of agricultural land and in turn has affected the gross agricultural production.

4. *Subsistence agriculture.* As has been mentioned earlier, 92 per cent of the gross sown area has been given to five food crops, namely paddy, wheat, mandua, jhangora and barley. Out of this, 30 per cent is currently under mandua and 20 per cent under jhangora and barley. The last three crops are of low value and low per-acre yield and yet they occupy 50 per cent of the agricultural land. Only 8 per cent of the gross cultivated land of the tehsil has been given to cash crops like vegetables, tobacco, pulses and oilseeds This indicates that agriculture in this tehsil is at the subsistence level only and is not in a position to support other sectors of the economy. About 49 per cent of the net sown area is under double cropping. This means that 50.8 per cent of the area is being given to single crops and is left fallow in the rabi season. The substantial acreage under double cropping may look impressive on the surface but the productivity of the second crop is so poor that the additional production is disproportionately low compared with the acreage under these crops.

5. *Soil erosion.* Soil erosion poses a difficult problem in this hilly tehsil. In areas with steep slopes, rain water runs off quickly removing the top soil. At places this run-off water creates gullies rendering the area unsuitable for agriculture. Soil erosion is more severe in uplands and areas lacking vegetative cover. This phenomenon is quite common in this tehsil and about 90 per cent of the cultivated land is affected by erosion. Due to the intolerable pressure on agricultural land, even the steep slopes which should otherwise have been forested, have been put to agriculture. The fields are terraced without regard to the contours of the land and often sloping towards the sides. This makes the fields susceptible to erosion and lower fertility. However, plans are underway to tackle this problem. In 1968-69, about 124.85 hectares were brought under soil conservation schemes by the State Department of Soil Conservation. This figure went up to 250.68 hectares in the year 1969-70 By 1970-71, about 291.31 hectares were taken up. Under the Fifth Five-year Plan, soil conservation schemes will cover an area of 7,500 hectares.

6. *Shortage of food crops.* All the problems mentioned above along with some common problems related to farming practices have resulted in the low productivity of crops and low gross agricultural production. Almost all the clusters in the tehsil are in shortage of one food crop or the other. The most alarming thing is that the tehsil is deficient in almost all the important food crops and more than half of its requirement has to be brought from areas outside the tehsil and even from outside the district.

The foregoing analysis makes it very clear that the tehsil suffers from a few extremely difficult handicaps which inhibit agricultural development. It would be easy at this point to suggest diversion of all development funds from agriculture to other more profitable alternatives such as horticulture, forestry and animal husbandry. This does not, however, solve the acute problem of food shortage in the tehsil. We have already mentioned the physical problems of bringing food from outside. It is necessary, therefore, to fully explore the untapped agricultural potentiality of the area.

Potentialities of Agriculture

The preceding discussion brings out very clearly that the low agricultural production in the tehsil is mainly due to (1) the small proportion of land under cultivation, (2) lack of

irrigation facilities, and (3) soil erosion and other related problems. An increase in the agricultural area and augmentation of irrigation will open up new horizons for the solution of the connected problems. Attempts have been made in the following sections to identify the potential agricultural areas which can be brought under agriculture in the near future. Irrigation potentiality has also been assessed in order to bring more areas under irrigation. At a later stage, various effective soil conservation measures which can be adapted to the conditions of this area, have also been discussed.

Identification of Potential Agricultural Land

Since the existing net sown area is very small and converting the fallow land into agricultural area will also not bring about a substantial increase in the agricultural area, a search for additional potential areas was made. Leaving out, for the time being, the fallow land which can be brought under cultivation, once irrigation facilities are developed, a careful analysis was made of two categories of land : (1) cultivable waste, and (2) barren and uncultivable land. It may be recalled from Table III.6 in Chapter III that in 1973, these two categories occupied 11.40 per cent of the total geographical area of the district. It was our purpose to find out whether any part of this land was salvageable or not. In order to do so, factors which govern the distribution of agricultural land in Pauri tehsil were identified first. This was done by superimposing the existing agricultural area map on different maps of contour, slope, soil drainage, solar radiation, proximity to settlements and accessibility. It was found that slope, soil, solar radiation, proximity to settlements and accessibility have maximum bearing on the distribution of agricultural land.* The operational procedure followed is described below.

Solar radiation. Temperature, which is an important governing factor in areas of high altitude, was also not considered in absolute terms of degrees. The reason is that meteorological stations are not fairly well distributed over the tehsil to provide the required data. Moreover, to consider temperature in an area of undulating topography would have been a complicated process. Instead of solar radiation, a simpler indicator was used. In order to find the areas which are negative from the view point of agriculture, shadow areas were marked on the map. It was further assumed that it is the morning Sun which has the highest degree of insolation as compared with the evening Sun. Thus, areas which do not get Sun for two hours in the morning were marked and checked up with the existing agricultural map. This exercise confirmed that these Sun-shade areas are mostly devoid of agriculture in spite of the availability of good soil and water. In looking for potential agricultural areas, the Sun-shade areas were, therefore, marked as negative for agriculture.

Soils. Another important factor is soil. No reliable information on soil was available for the study area. In the absence of this we adopted the results of soil studies made by Mukerji and Dass in Chanbattia hills in Almora district.† The findings of their study provided norms to identify areas of different soil types. The following are the main genetic types of soils.

1. *Red loams.* It is found that along slopes of hills or ridges the profiles are generally sandy in nature. These areas receive maximum solar radiation and are always dry owing to their situation on the ridges of slopes.

* Since the study area receives high rainfall (average 60.5″) which is distributed more or less evenly throughout the tehsil, this factor was not considered.

† Mukerji and Dass, *Studies of Kumaon Hill Soils* quoted in Ray Chaudari *et al.*, *Soils of India*, I.C.A.R., New Delhi, 1962, p. 319.

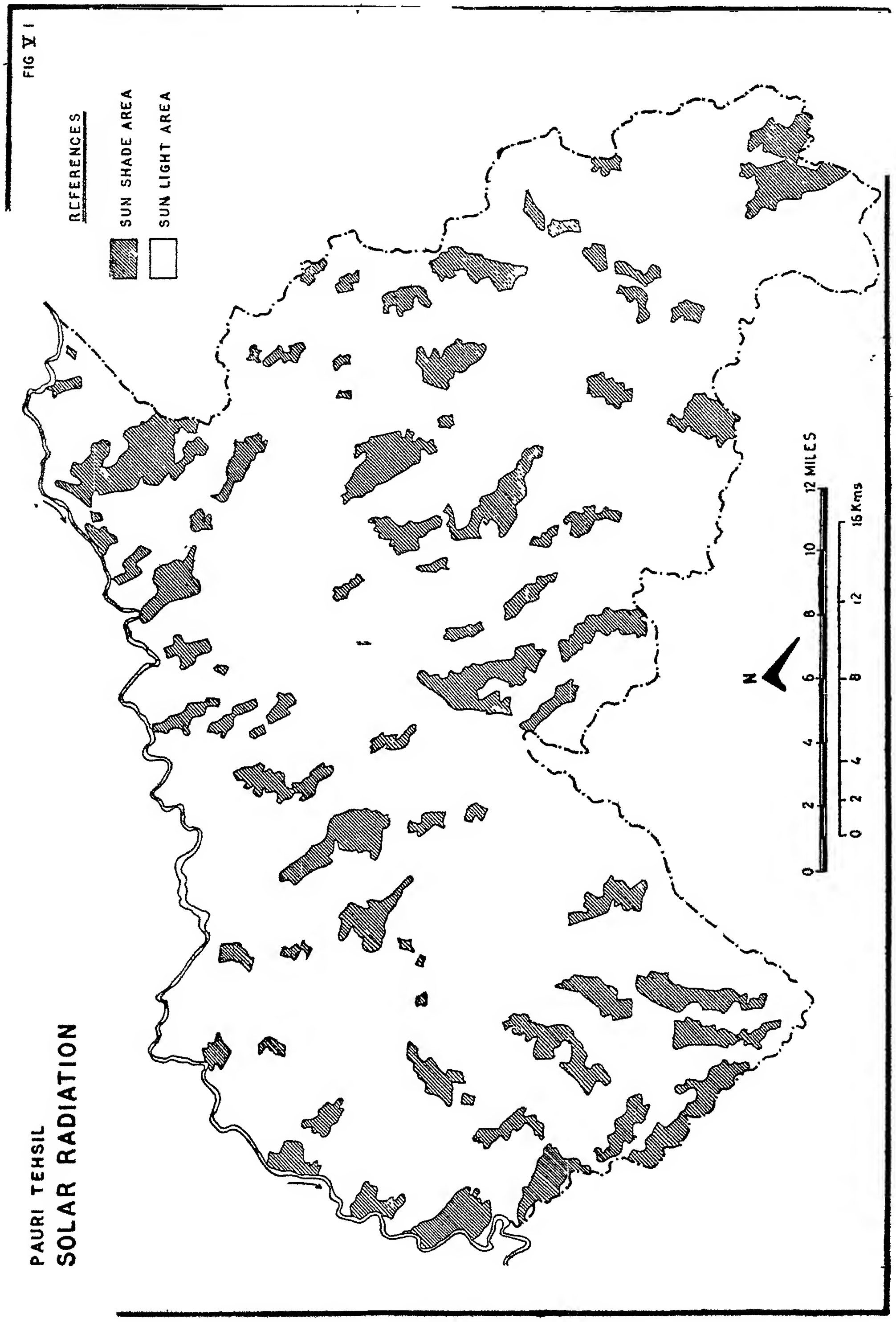


FIG V I
PAURI TEHSIL
SOLAR RADIATION
REFERENCES
SUN SHADE AREA
SUN LIGHT AREA
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 Kms

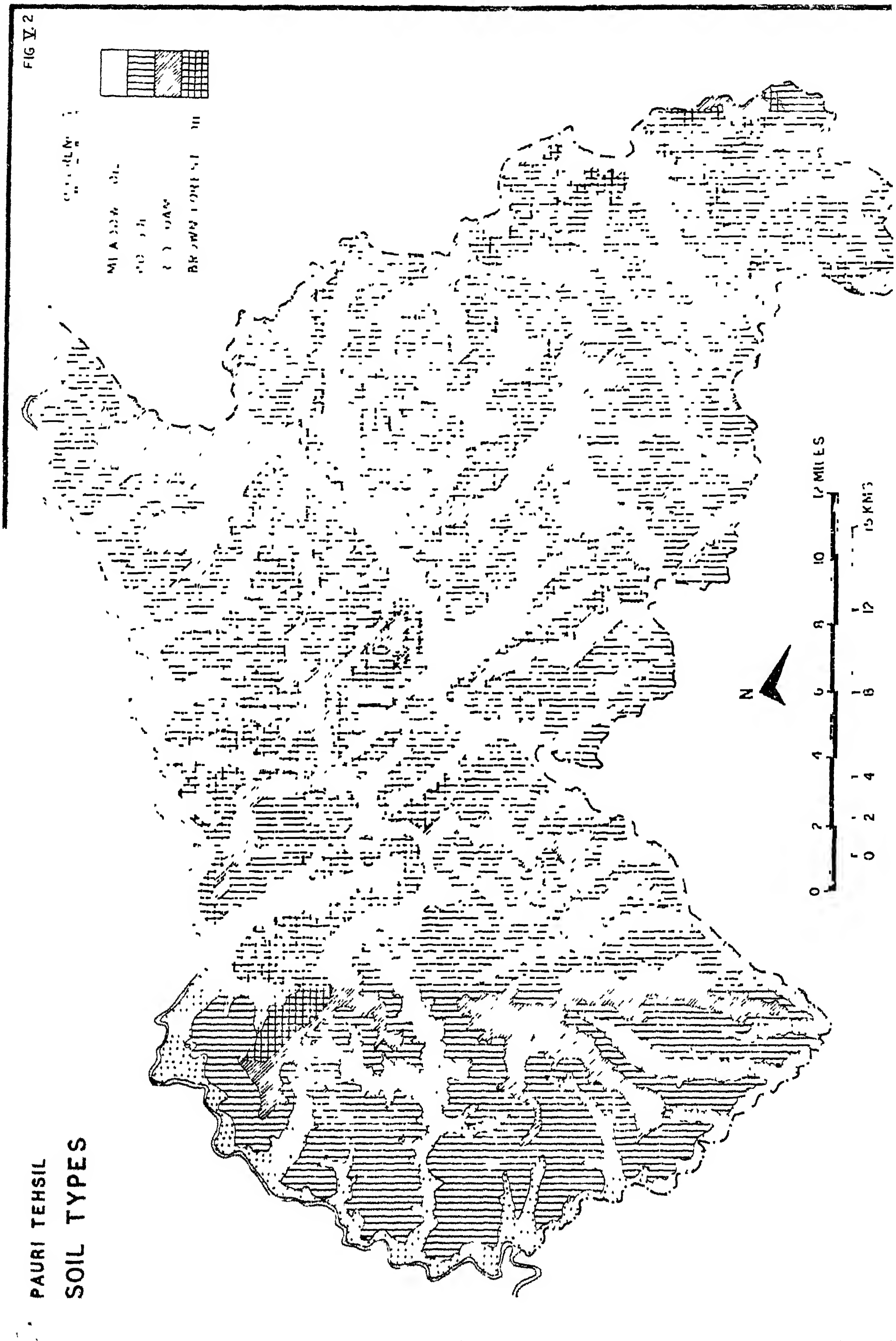
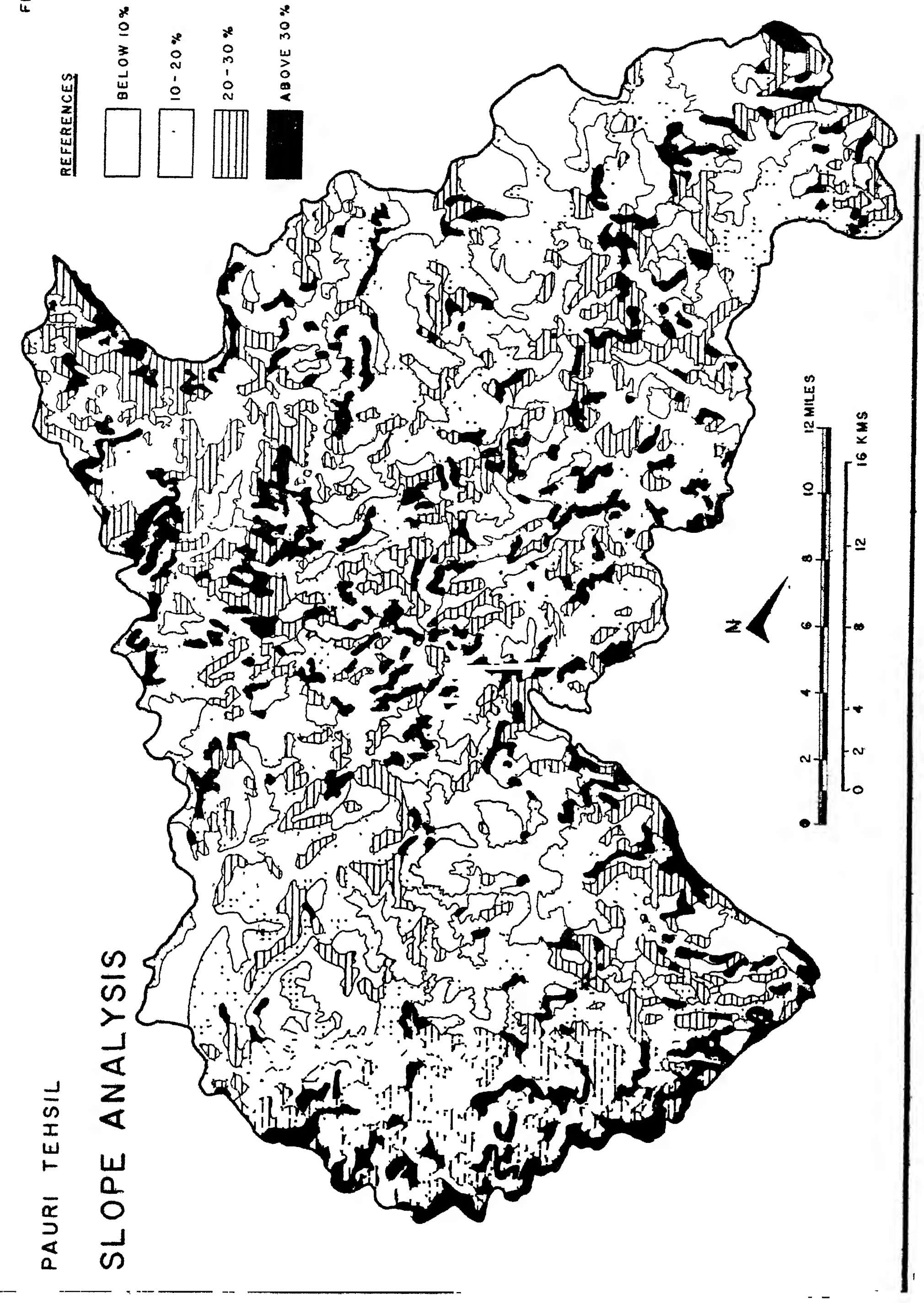


FIG V. 2
PAURI TEHSIL
SOIL TYPES
N
MILES
KMS

FIG. V.3


PAURI TEHSIL
SLOPE ANALYSIS
REFERENCES
BELOW 10%
10-20%
20-30%
ABOVE 30%
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

2. *Brown forest soil.* Most of the soils of these localities belong to this type. The position of profiles along slopes determines the textural character of this group.

3. *Podsol.* It develops under mild slope gradients and in pockets of hills and ridges and in shady places.

4. *Meadow soil (wiesenboden).* It is found near nullahs or water streams and cool and low lying shady places. Owing to the very high ground-water level, the soil always remains moist and during winter a thick matting of frost covers them.

With the help of contour, drainage, slope and solar radiation maps, the above mentioned soils were located. A comparison of the soil map with the agricultural map showed that the first two categories of soil *i.e.*, red loam and brown forest soil are generally not used for agriculture. Areas of red loams are essentially ridges. These areas along with brown forest soil areas were mainly under forests.

Slope. Slope also plays a significant role in the distribution of agricultural land. It is an accepted fact that areas with more than 30 per cent slope are not fit for agriculture.* Areas with more than 30 per cent, 20 per cent to 30 per cent, 10 per cent to 20 per cent and below 10 per cent slope were marked on a map. These different categories indicated different classes of land with various degrees of suitability for agriculture.

Drainage. A drainage map was prepared showing the pattern of perennial streams. This was taken as a water resource map. Since the available rainwater in the area is not enough to meet the minimum water requirements of most of the plants (see Table V.2) this factor was taken as adding to the quality of agricultural land by facilitating irrigation.

Proximity to settlements and accessibility. Accessibility and the proximity to settlements were considered but were given the least importance. It was assumed that wherever all other geographical factors are in favour of agriculture, the area can be made accessible by proposing means of transportation. It was also foreseen that improved accessibility and availability of agricultural land will undoubtedly attract human habitation.

The above study made it possible to list out a number of negative factors which stand in the way of agriculture in the study area. These factors are—

1. (Topography) ridges.
2. Above 30 per cent slope
3. Sun-shadow areas
4. Red loams
5. Reserved and dense forests

It was decided not to disturb the existing reserved and dense forests. This was, therefore, also included in the list of the negative factors.

A sieve map was prepared superimposing all the five negative factors. The areas which were occupied by the negative elements were taken as negative areas and were shaded. The existing agricultural land map was superimposed on it and the areas which were not shaded in the sieve map (or were outside negative areas) were traced out on the agricultural map. Thus in addition to the existing agricultural land we could get the potential agricultural areas also.

These potential agricultural areas were then compared with the accessibility map and for inaccessible cultivable areas proposal was made to improve accessibility.

* Vernon (1958) quoted in Webster, C.C. *et al.*, *Agriculture in the Tropics*, English Language Book Series, Longmans, London, 1966, p. 107.

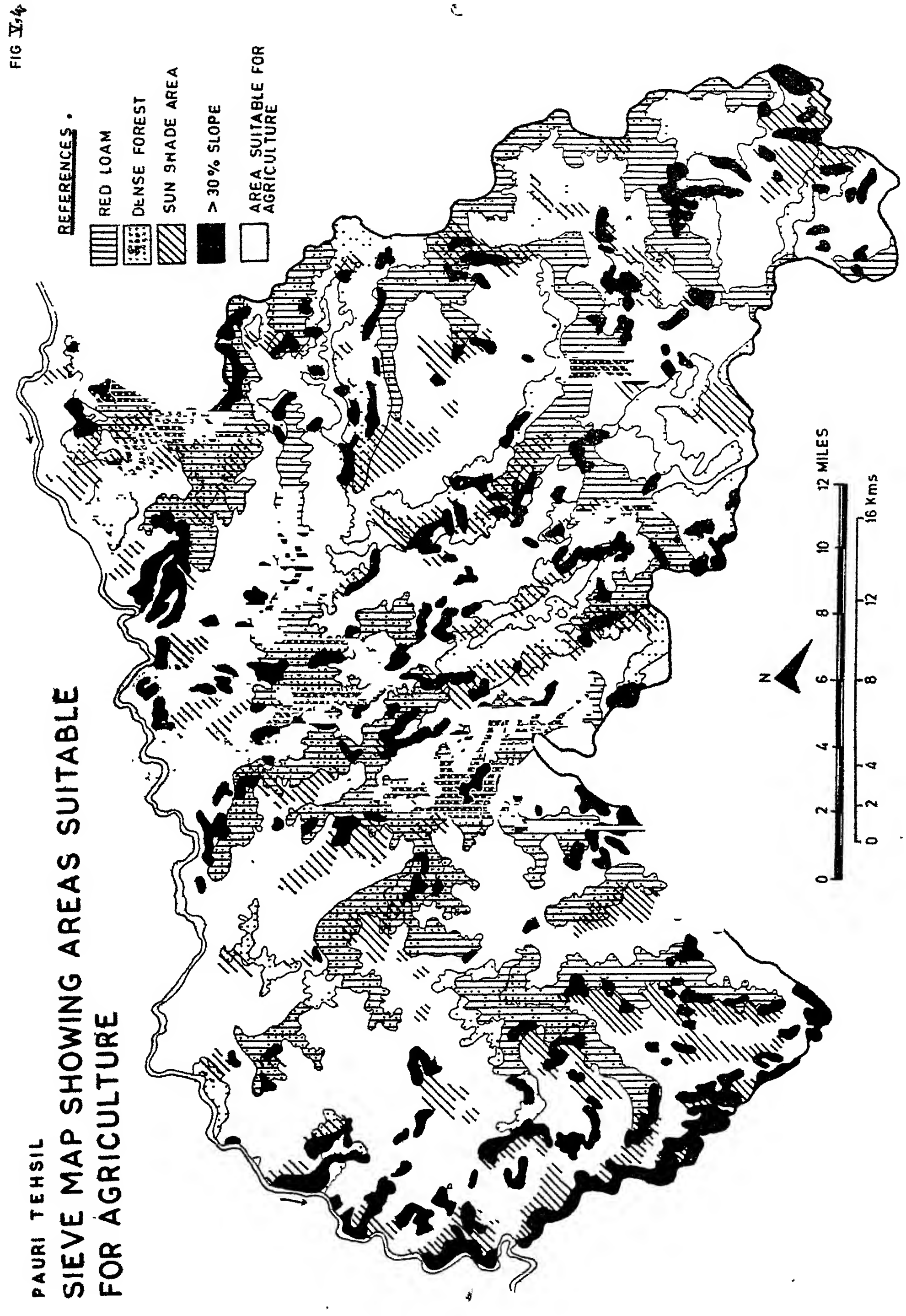


FIG V,4

PAURI TEHSIL

SIEVE MAP SHOWING AREAS SUITABLE FOR AGRICULTURE

The total potential agricultural area in the tehsil comes to 17,830 hectares (8 per cent of the total area). By extending agriculture to these areas the total agricultural area of the tehsil will be as large as 72,703 hectares. This will constitute 33.0 per cent of the total geographical area of the Pauri tehsil.

It must be mentioned at this point that in these potential agricultural areas agriculture has to be practised with soil conservation and irrigation practices, wherever needed.

Distribution of Potential Agricultural Land

The potential agricultural land is not uniformly distributed throughout the tehsil. Out of 72 clusters, there is no potential agricultural land in 6 clusters (Appendix V. 2). In the rest of the clusters the potential agricultural land shows great variation in extent. The maximum potential agricultural land is in Baganikhal cluster where 755 hectares fall in this category. This area is equal to 71.63 per cent of the existing net sown area of the cluster.

Assessment of Irrigation Potentials

The irrigation potential of the tehsil has been studied mainly on the basis of the availability of surface water. In the absence of information on ground-water, this particular source has not been considered here. The present study has been limited to the run-off of the catchment areas lying within the tehsil. For this purpose the mean annual rainfall has been found out taking the per annum rainfall for the last decade *i.e.* 1951-61. This figure comes to 153.86 cm., whereas the total catchment area is 2,21,100 hectares. Thus the average annual precipitation is 340 million H cm.*

Out of the total surface water in the tehsil, only a certain percentage is available for irrigation. T.G. Barlow who studied the catchment area in U.P. found that the run-off percentage in hilly and steep areas is 33 per cent of the precipitation.** According to this norm, the run-off in the tehsil will be 14.5 million H cm. Out of this, a portion of water has been utilized by the existing irrigated areas. How much water has already been exploited can be calculated taking from the area under irrigation and the crop to which the land has been put. The irrigated area is 1,079 hectares and the crops grown on this land are paddy, wheat. The additional water requirement of these crops, over the quantum of rain water used, is 39.8 and 19.03 cm., respectively. It means that $39.8+19.03=58.83$ H cm water is being consumed by these crops. Thus the total water utilised in the tehsil through irrigation will be—

$$1079 \times 58.83 = 63{,}500 \text{ H cm.}$$

If we deduct this quantity of water which is already tapped from the total run-off, we will get the total surplus surface water that can be used for future irrigation schemes.

Eventhough there is abundant water resource in the tehsil, it will be impossible to irrigate all the agricultural areas. Therefore, areas which can be irrigated have been found out. This has been done with the help of maps. On a contour map of 200 metres interval, all perennial streams were plotted and agricultural areas were also marked. Then the existing irrigated areas and the areas which are proposed by the State Irrigation Department to be irrigated during the Fifth Five-year Plan were also plotted. This way it was possible to

* 1 H cm = 1 hectare–centimetre.

** Barlow, T.G. quoted in Kushalani, K.B. *et al.*, *Irrigation Practices and Design*, Oxford and IBH, Delhi, 1971, p. 285.

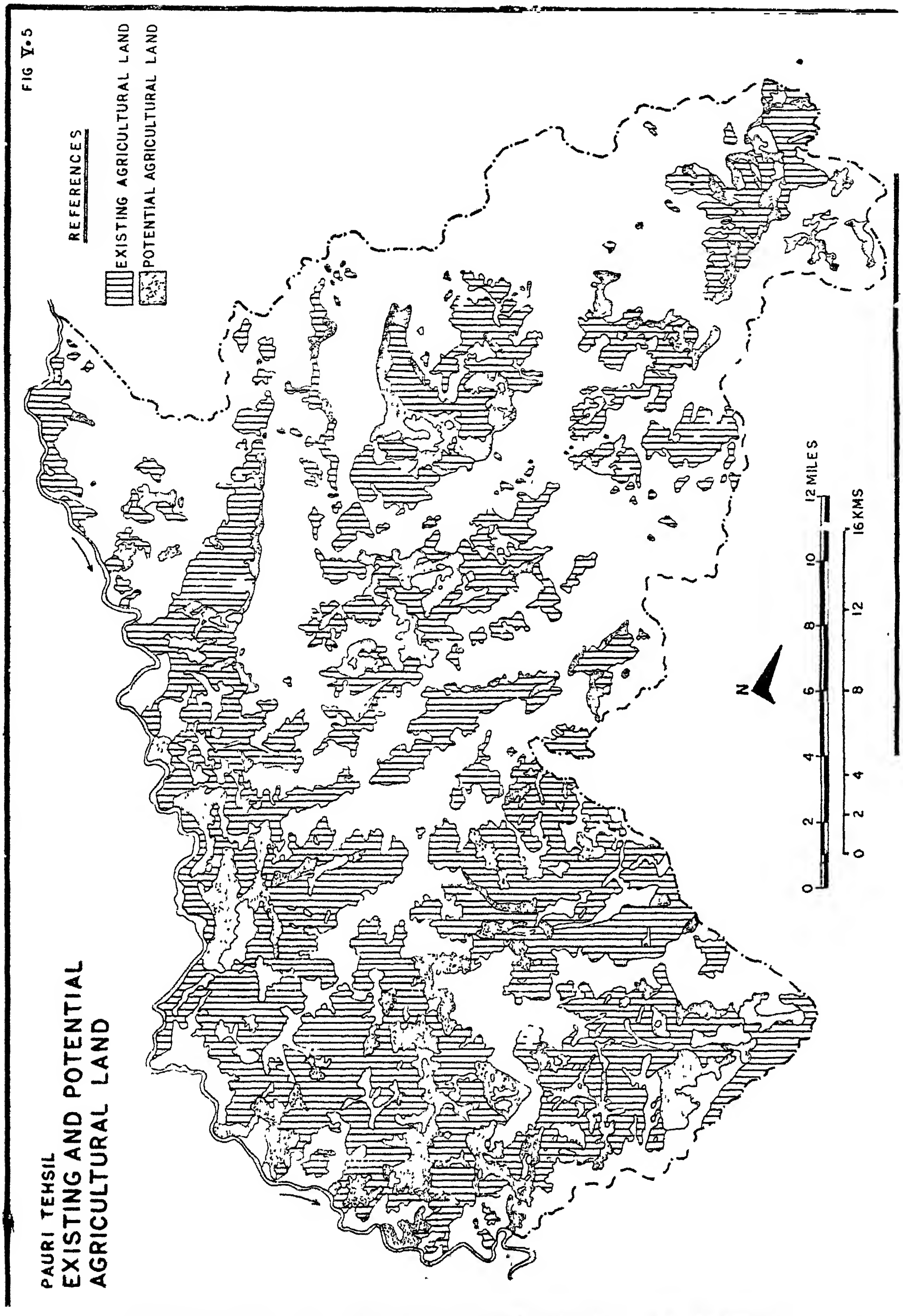


FIG V.5
PAURI TEHSIL
EXISTING AND POTENTIAL AGRICULTURAL LAND
REFERENCES
EXISTING AGRICULTURAL LAND
POTENTIAL AGRICULTURAL LAND
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

mark out large unirrigated areas with relatively gentle slopes lying near the perennial streams. These are the locations where irrigation is possible.

The second problem was to assess the extent of area which can be irrigated at different locations. Three factors were considered in doing so. These were :

1. additional water requirement of the crops grown on that piece of land;
2. quantity of water available at different points for exploitation; and
3. topography of the agricultural area.

To arrive at how much area will be irrigated, the cropping pattern for these areas was first projected. At present, all the irrigated areas are under paddy followed by a second crop of wheat. It was assumed that in future also this trend will continue. The additional water requirement of these two crops, as has been mentioned earlier is 58.83 cm. Thus the water requirement of an area will be

Area to be irrigated x 58.83 H cm.

On the basis of the per hectare water requirement and the run-off available for utilization, it was found that for irrigating one hectare of land, 1.1766 hectares of catchment area is needed.

The extent of land that can be irrigated was decided by the availability of agricultural land and the availability of water in the nearby perennial source. The locations were selected in such a way that the additional water requirement of the agricultural area is less than the availability.

Since the run-off estimated by Barlow's formula* does not take into account the specific geographical condition of the area, particularly the slope of the drainage area, the adequacy of water for each irrigation scheme was checked using Justin's formula**. This formula in its mathematical form can be expressed as follows :

$$R = 0.934 S^{0.155} \times \frac{P^2}{T}$$

where

R = Run off in inches

P = Precipitation in inches

T = Temperature in Fahrenheit

S = The slope of the drainage area found by dividing the maximum difference in elevation on drainage area by the square root of the drainage area

In addition to the precipitation, this formula takes into account the slope of the drainage area and the temperature. The total area that can be irrigated is thus estimated as about 11,600 hectares and requirement of water will be 6.84 million H cm. constituting 5.1 per cent of the total run-off water.

The third aspect of irrigation planning is to decide the methods of irrigation. For this also maps were used. With the help of contour maps at 200 metres interval and of perennial streams, areas where gravity flow is possible were shaded. Areas other than this, lying within 500′ above the level of source of water, were proposed for lift irrigation. These lift irrigation schemes were then scrutinized and where it was possible to irrigate above 40 hectares, the areas were selected. Thus the lift irrigation schemes are clustered to cater to

* *Ibid.* p. 285.

**. *Ibid,* p. 290.

the needs of large agricultural areas and are not scattered in small patches all over the tehsil. The idea behind this policy was to make economic use of electricity and to avoid unnecessary expenditure in taking the transmission lines to every nook and corner.

The future net irrigated area will be 12,723 hectares (Appendix V. 3). Out of this 55 per cent will be irrigated by gravity flow and 45 per cent by lift irrigation (Appendix V.4). These schemes have been distributed throughout the tehsil.

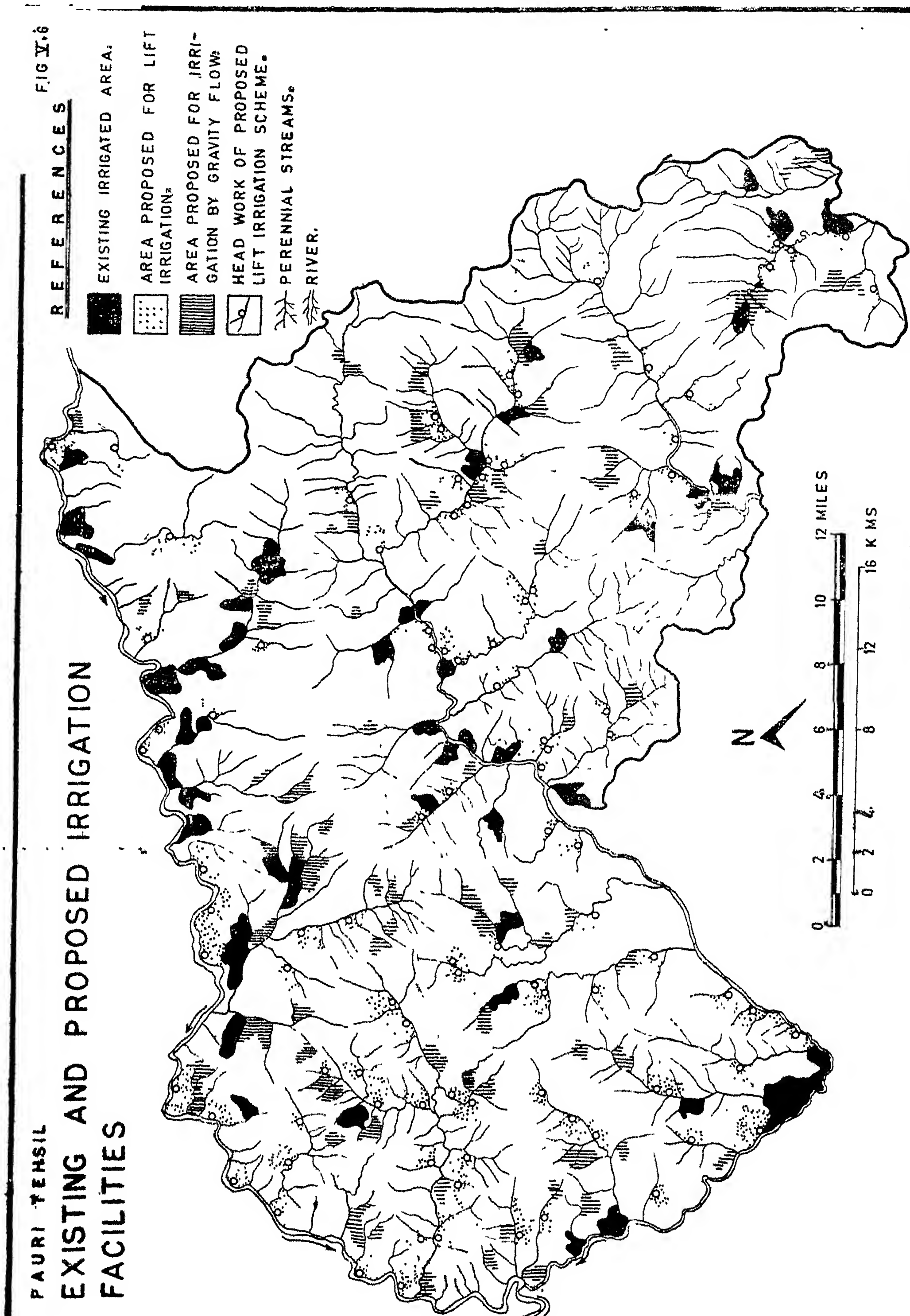
A third means of irrigation can also be introduced in this area. These are tanks which are a common feature in hilly areas. In places where gravity flow or lift irrigation is not possible due to some reason or the other, tanks can well serve the purpose. Rain water can be stored in natural depressions wherever they exist, forming tanks. Otherwise a few selected valleys can be dammed up to store water. Tank irrigation can be complementary to canal and lift irrigation.

Requirement of Pumps

In our earlier analysis (Table V.2) of water requirement for different crops, it was found that paddy and wheat require maximum irrigation in the study area and the deficits were found as 39.8 cms and 19.03 cms. respectively. Since the paddy crop in kharif is followed by wheat in rabi, the total requirement of irrigation water will be the aggregate of these two (58.83 cms). However, the total quantity of water to be lifted during the whole year does not have much significance in deciding the capacity and requirement of pump-sets. The capacity of pumps will be decided by the peak deficiency of water occurring in a particular period of time in the whole crop season. The crop period of paddy in the tehsil is from May to September. During this period, the decennial average number of rainy days is 44, varying from 3 in May to 18 in the month of July. Hence the requirement of irrigation may not be the same throughout the crop period. Similarly, we cannot assume that the total requirement of irrigation can be met by lifting every day uniformly. This will be more evident from Table V.7.

TABLE V.7 : PERIODICAL WATER REQUIREMENT OF PADDY

S. No.	Period	Month	No. of days	Water requirement in Hcms		No. of rainy days	Rain-fall in cms.	Water requirement by irrigation	Remarks
				Daily	Total				
1.	Nursery	May—June	28	1.09	30.52	3	4.9	—25.62	Nursery area will be only 6.6 per cent of total area
2.	Transplantation and after	June to 1st week of July	35	1.09	38.15+ 7.62	7	24.2	—21.57	7.62 cms. of water is required extra during transplantation
3.		July	26	1.09	27.25	18	40.8	+13.55	
4.		August	31	1.09	33.80	16	39.8	+ 6.00	
5.	Before harvesting	September	30	1.09	32.70	10	19.2	—13.50	Irrigation is needed 3-4 weeks before harvesting


PAURI TEHSIL
EXISTING AND PROPOSED IRRIGATION FACILITIES
FIG V.6
REFERENCES
EXISTING IRRIGATED AREA.
AREA PROPOSED FOR LIFT IRRIGATION.
AREA PROPOSED FOR IRRIGATION BY GRAVITY FLOW.
HEAD WORK OF PROPOSED LIFT IRRIGATION SCHEME.
PERENNIAL STREAMS.
RIVER.
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 K MS

From the Table V.7 it can be seen that the maximum deficiency of water will occur during the months of May and June. The requirement of water during May is only for the nursery plant. Since the area of nursery required is only 6.6 per cent of the total cultivated land, the nursery area is generally chosen near the 'Nallas' where there is sufficient moisture throughout the period. The maximum deficiency (21.57 Hcms), therefore, will occur during the month of June and the capacity of pumps will be decided by this.

To obtain the capacity of pumps, the water requirement for irrigating the land was first calculated by multiplying the area with the deficit quantity of water in the peak period. From this, the discharge in gallons per minute required was obtained. The power requirement of the pump was then estimated using the formula :*

$$\text{BHP} = \frac{\text{G x Total head}}{\text{3300 x efficiency of pump}}$$

where BHP = break horse power

G = water to be lifted in gallons/minutes

Total head = Static head + 1/3 static head for loss due to friction and slip of valves.

Efficiency of the pump is assumed as 75 per cent.

By making use of the above formula, the capacity of pump-sets required in each cluster was worked out as shown in Appendix V.4. The total horse power requirement during 1979 and 1984 is estimated as 19,200 and 42,700, respectively (Appendix V.4). Since the requirement of irrigation for wheat is much less than paddy, pumps with the above capacity can easily irrigate the second crop.

Irrigation Intervals

The crops do not require irrigation every day. The duration between two irrigations is decided by the following empirical formula.**

$$D = \frac{Ws}{Wd}$$

where D = the duration between two irrigations

Ws = water required to wet soil of one foot depth

Wd = daily requirement of water for a particular crop

The value of Ws for different soils is as follows † :

1. Sandy soil 1.27 cms
2. Sandy loam 2.54 cms
3. Loam 5.10 cms
4. Clay loam 6.25 cms
5. Clay soil 7.62 cms

In the study area, the paddy cultivation is confined to the loam area. The value of Ws in this case is, therefore, 5.1. Assuming the daily requirement of water for paddy as

* Khanna, P.N., *Indian Practical Civil Engineers' Hand Book*, Engineers' Publishers, New Delhi, 1966, p. 84.

** Indian Council of Agricultural Research, *Handbook of Agriculture*, ICAR Publication, New Delhi, 1969, pp. 619-20.

† *Ibid.*

1.09, the duration between two irrigations can be worked out as $\frac{5\ 1}{1.09}$ = 5 days (approximately). Hence the whole area which requires irrigation has to be divided into 5 equal parts and one portion can be irrigated every day.

Recommendations for the Development of Agriculture in Pauri Tehsil

An assessment of the present position of agriculture in the tehsil, understanding of its problems and an evaluation of its potentialities indicate that the present pattern of agriculture needs to be modified in the future. This is necessary in order to make the optimum possible use of land which will consequently bring economic development to this area. The changes which need to be introduced should be governed by the following policies :

1. All fallow areas should be brought under agriculture by 1979.
2. Total potential area should be put to agriculture by 1984.
3. Forty per cent of the proposed irrigation schemes should be completed by 1979 and the remaining 60 per cent by 1984.
4. About 18 per cent of the net sown area should be irrigated by 1984.
5. Area under paddy, wheat and other crops should be increased.
6. Double-cropping should be introduced in irrigated areas.
7. Farming techniques should be modernised as far as possible.
8. Soil conservation practices should be introduced on a priority basis.
9. Infrastructure facilities should be provided wherever needed.

These principles are the guidelines for the formulation of the future plan of agriculture in the tehsil. Proposals have been made for this purpose for a period of ten years, *i.e.*, 1974-84. To make the task of implementation easy, the plan period is further divided into two phases, each with a time span of five years. It was also foreseen that in the first phase, the projects may take time to gain momentum. It has been assumed, therefore, that only 40 per cent of the total irrigation work will be possible during the first phase. Keeping this in view, all programmes have been split into two phases for implementation.

It is proposed that during the period 1974-79 all fallow lands should be brought under agriculture. Since these areas were once under agriculture and due to some reason or the other, are now lying fallow, these lands can be again put to agriculture with a minimum effort. The total fallow land is about 11,470 hectares. It means that nearly 2,300 hectares have to be converted into agricultural land per annum which is reasonable. On the completion of these schemes the net sown area in the tehsil in the year 1979 will be 54,873 hectares which will be 24.8 per cent of the total geographical area as against 19.63 per cent at present.

Expansion of agriculture to the potential land will be relatively more difficult. It is recommended, therefore, that this task be taken up during the second phase of the plan. These are the areas where land has to be prepared for farming by terracing. Improvement in accessibility is also a pre-requisite. These areas also need more effort and expenditure for their transformation into agricultural land. There are 17,830 hectares of land which fall in this category. Annually 3,500 hectares of land has to be converted into agricultural areas to achieve the goal by 1984. Thus, by the end of the plan period the total net sown area will be of the order of 72,703 hectares constituting 33 per cent of the total geographical area of the tehsil (Appendix V.2).

Irrigation schemes which also involve high investment in construction, storage and electrification of the area, have also been split into two phases (Appendix V.3). During 1974-79, only 40 per cent of the total schemes is recommended to be taken up. This will increase the irrigated area to 6,476 hectares. In fixing up priority, it was decided that the irrigation projects to be taken up during this phase will be confined to the existing agricultural area and the fallow lands to be brought under agriculture within that period. During 1974-79, lift irrigation schemes which are in or near areas already electrified should be given first preference. The second preference should go to schemes in those areas which are recommended to be electrified during 1974-79.

By the end of 1984, the remaining schemes can be completed. It is in this phase that the schemes falling in potential agricultural areas are proposed to be taken up. Total area irrigated up to 1984 will be 12,723 hectares. This is 17.5 per cent of the total agricultural area.

Since food production in the tehsil falls short of the total requirement, it is recommended that the cultivation of food crops be encouraged (Appendix V. 5 and V. 6). Among food crops more emphasis should be given to paddy and wheat as their yields are the highest. The maximum shortage at the present time are in these two crops as they are the major staples in the area. It is recommended that the maximum possible acreage should be brought under these two crops. The allocation of new areas to paddy and wheat will depend upon the topography and availability of water. Since these two crops require additional water, these have to be grown in irrigated land or in valleys where the water retentive capacity of soil is more. The valleys and areas irrigated by canals and lift irrigation should, therefore, be allotted to paddy in kharif season, and to wheat in rabi season. This is the present pattern and should be followed in the newly irrigated areas. On uplands where there is no irrigation, new lands should be allotted to mandua and jhangora in the same proportion as it exists in different clusters. Mandua can be grown mixed with pulses. This way the area under pulses can be increased. Jhangora has to be followed by barley. At present barley is grown as a rainfed crop but it can be irrigated by springs and tanks as its additional water requirement is low. Other areas which can be irrigated by springs and tanks and are near settlements should be allocated to crops like vegetables, pulses, oilseeds and tobacco.

With the increase in irrigated area the land can be put to intensive agriculture. Thus the area under double crops will be increased substantially (Appendix V. 5 and V. 6). This will also be reflected in the cropping pattern and the crop rotation system will undergo some modification. The following crop rotation is suggested :

Paddy—Wheat
Mandua—Potato/Tobacco/Mustard
Jhangora—Pulses/Barley
Vegetables—Vegetables

Improvement in farming techniques will also increase the per acre yield. The most important modifications in the prevalent technique will be the introduction of high-yielding variety of seeds,* fertilizers, pesticides and irrigation. Although there will be some increase in the per acre productivity of different crops in the tehsil due to these factors, it is doubtful whether the increase will be as high as observed in plain areas. The difficult topo-

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* Some of the high-yielding varieties suitable for this area are paddy (T.N.I and I.R-8), Mexican wheat and barley (K. 84).

graphy, small fragmented plots, soil erosion, lack of accessibility and many other problems have contributed to an abnormal situation for agriculture in the tehsil. The prevalent per acre productivity of crops in this area is quite low as compared with the plain areas. The increase in productivity which may be brought about by improved techniques will also be subject to some of the existing limitations. In addition, the current shortage of fertilizers and very high prices are likely to continue indefinitely. This factor may also reduce the proportion of acreage under high-yielding varieties. We have, therefore, taken a conservative view of the potential increase in the per acre productivity of crops. Table V.8 will show the existing productivity per hectare and the expected yields per hectare for the years 1979 and 1984.

TABLE V 8 . EXISTING AND ESTIMATED CROP PRODUCTIVITY IN PAURI TEHSIL (QUINTALS/HECTARE)

S.No.	Name of Crop	1973	1979	1984
1.	Paddy-rainfed	7	8	10
2.	Paddy-irrigated	10	15	20
3.	Wheat-rainfed	6	6	8
4.	Wheat-irrigated	10	10	15
5.	Barley-rainfed	4	4	5
6.	Barley-irrigated	8	8	10
7.	Mandua	4	4	5
8.	Jhangora	4	4	5
9.	Pulses	4	4	5

Soil Conservation Measures

Soil erosion in the tehsil can be arrested in three ways.* These are :

1. By putting the land to proper use. Thus each type of land should be used only for such agriculture or forestry for which it is suited without taking undue risk of soil erosion.

2. By employing soil conservation methods of husbandry on each type of land, namely, contour planting for tree crop plantation and tie-ridging and strip cropping for arable crops. It is essential to maintain the fertility of the soil as well as to provide a self-protecting land use. This will minimise the cost and waste of land involved in the use of earth works for erosion control.

3. By adopting appropriate mechanical conservation measures.

Keeping in view the above three measures the following policies are recommended for soil conservation in the tehsil.

(*a*) Areas with more than 30 per cent slope should be brought under forests.
(*b*) Ridges should also be under forests.
(*c*) Agronomic measures for soil conservation should be employed on each type of land.
(*d*) Wherever necessary, appropriate mechanical conservation measures should be taken up.
(*e*) Expansion of agricultural areas and soil conservation measures should be taken up simultaneously.

* Webster, C.C., *et al*, Agriculture in the Tropics, EL.BS and Longmans, London, 1966, pp. 108-14.

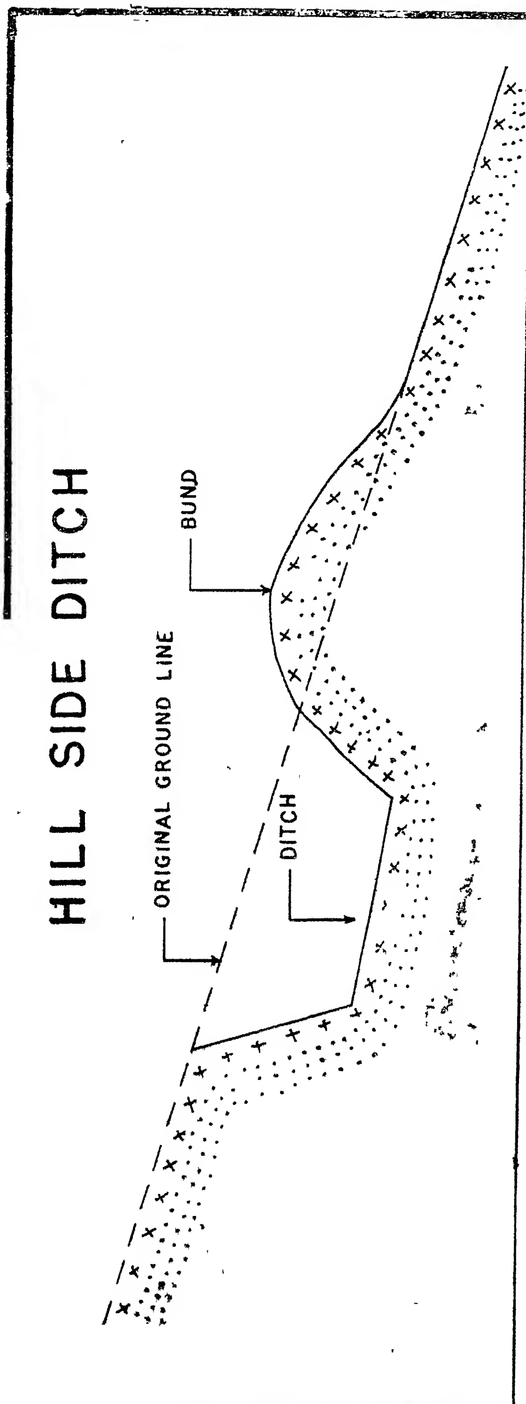

HILL SIDE DITCH
ORIGINAL GROUND LINE
BUND
DITCH

FIG V·7

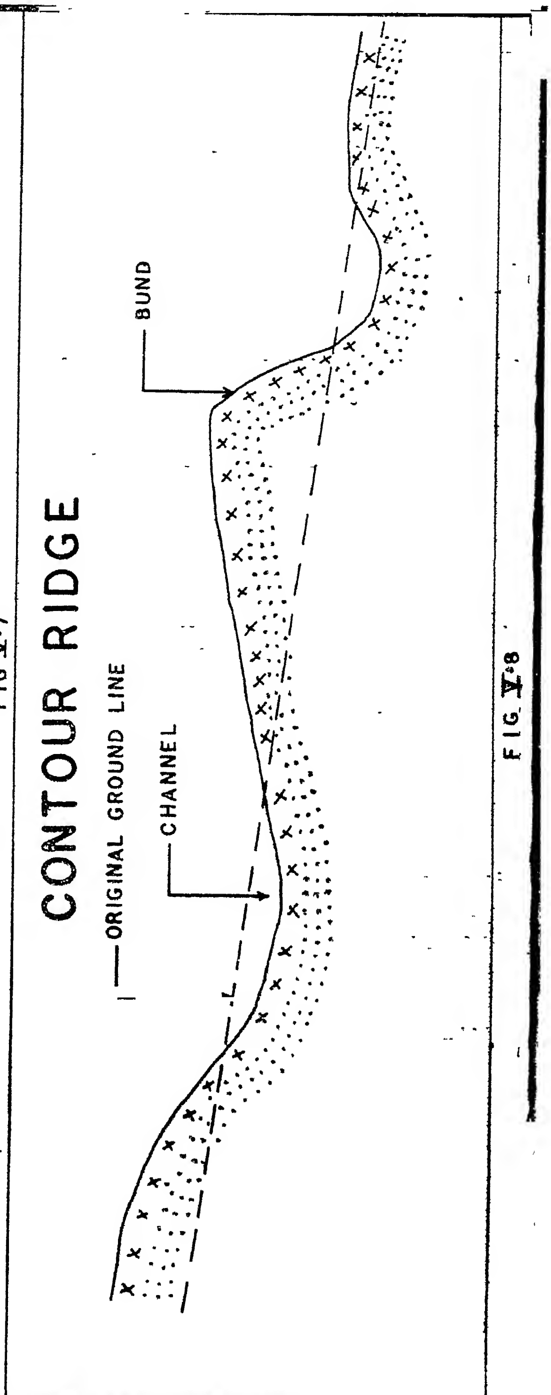

CONTOUR RIDGE
ORIGINAL GROUND LINE
BUND
CHANNEL

FIG V·8

The various methods of husbandry and mechanical conservation suitable for different areas in the tehsil have been described in the following sections.

Agronomic Measures for Soil Conservation

1. *Tillage.* Ploughing and cultivating on the contour is one of the simplest and cheapest conservation measures. This practice reduces soil erosion by reducing the velocity of water run off and increasing infiltration of rain water in the soil. It also interferes very little with the farming operations. By itself this measure will be useful in areas of gentle slope. But in steeper areas it has to be accompanied by other measures.

2. *Tie-ridging.* In this method the ridges are given to crops which are made roughly on contour and by joining adjacent ridges at regular intervals. These ridges are made of the earth scrapped from furrows. The rain water gets infiltrated in these basins and thus prevents the run-off of water except in case of intensive storms. The advantage of this method is that it can eliminate the need for other conservation measures such as terraces or vegetative cover which takes up space that might be cropped. Secondly, there is no difficulty in storing the water in furrows. The limitation of this method is that it is not effective in areas of steep slope.

3. *Contour strip cropping.* In this method, relatively narrow strips of different crops are planted on the contour. One strip of crop susceptible to erosion is separated by another strip growing protective crops. The densely planted strips slow down the velocity of water and cause it to deposit much of its silt load. In this way it affords protection to susceptible crops and controls erosion. It is desirable that the planting and harvesting times for these two crops are not the same.

4. *Vegetative buffer strips and barriers.* Permanent contour strips of grass may be used alone or along with mechanical measures. In case it is done, runoff velocity will be reduced and the silt will be deposited behind the barrier. Gradual accumulation of silt in these areas gives the effect of bench terracing. However, where there are gaps in the vegetative belt, its effect vanishes. Another disadvantage is that the grass may spread and needs to be arrested. Moreover, in areas falling within a distance of several feet to such barriers, the growth of crops is depressed. This method like many other agronomic measures is satisfactory only on gentle slopes.

Mechanical Measures for Soil Conservation

1. *The hillside ditch.* It is a ditch with a gentle slope of half to one per cent. This is made by removing the earth from the furrow and placing it on the lower side. These ditches may have a width of 1½ feet and length of 600 feet. This type of ditches can help in soil conservation in areas having more than 20 per cent slope. This can be best used with a plant barrier along the upper sides of the drain (Fig. V. 7).

2. *The contour ridge.* This is an earthen ridge 4 to 12 feet wide at the base and 1 or 2 feet high. It is built along a contour or on a slight grade. There is a channel in the upper side and sometimes on the lower side also (Fig. 8). This type of ridges can be constructed with hand or animal drawn ploughs also in areas with 10-20 per cent slope. The permissible gradient is three-quarter per cent. It can drain only up to 1000 ft. in one direction. The ridges can be protected by plants.

3. *The broad-based ridge terrace.* It is a large and low ridge. The ridge varies in width from 10 to 40 feet whereas the height ranges from 1½ to 2½ feet. There is a broad

shallow channel above it which permits the whole of the land to be filled and cropped (Fig. 9). The method is applicable in areas having 2 to 12 per cent slope. Since large amounts of earth have to be removed to construct it, the work can be done with terracers and graders. Taking into consideration the quantity of rainfall and the absorptive capacity of the soil it is suggested that they may be graded. The fall may be increased by one per cent for each successive 100 or 200 feet of channel up to a maximum of 5 per cent. These terraces can have a maximum length of 350 yards.

4. *Bench terraces.* It is the oldest conservation measure. It consists of a series of steps cut into the slope along contour. The forward edges are nearly vertical and never cultivated (Fig. 10). Terraces can be faced with vertical masonry walls. These benches often slope towards a drain at the back. The drain has one per cent gradient. The method is expensive and can be used for high priced crops only. This is also made for the conservation of water and irrigation, *e.g.*, for the hillside cultivation of wet rice.

5. *Storm drains or diversion ditches.* In order to protect arable land, areas lying above it and have not been put to agriculture have to be treated by a different soil conservation measure. Storm drains are a means to carry the storm water of such areas before it reaches the arable land at lower levels. These are wide and shallow channels. The excavated earth is placed on the lower side to form an embankment. The drain has a gradient ranging between quarter and one per cent. Channels as well as banks are protected by a grass cover.

6. *Outlets.* It is important that outlets for storm drains should be provided for the prevention of erosion elsewhere. The water, for this reason, has to be discharged at a very low velocity. Ditches and stable waterways can be taken as a disposal tank. In the absence of such natural waterways artificial tanks can be constructed by putting bunds along the course. Water can be stored in these tanks in rainy seasons and whenever needed can be utilized for irrigation purposes. It is estimated that for every acre of catchment area one foot wide waterway is needed.

The above mentioned soil conservation measures will help maintain the vaneer of soil in the agricultural areas and increase the productivity of crops.

Another important measure for the development of agriculture in the tehsil would be the provision of infrastructural facilities. This has been dealt with in the next chapter in detail.

Estimated Production and Consumption of Agricultural Produce in 1979 and 1984

It is necessary to assess to what extent the demand for agricultural produce can be met after implementing all the proposed schemes. For this purpose, population was projected for the year 1979 and 1984,* and on the basis of the food habits of the people (Table V.5), the demand for food in these years was estimated (Appendix V. 7 and V. 8).

The estimated production for the year 1979 has been based on the assumption that by this time, all the fallow land will be put to agriculture, selected irrigation schemes will be completed, suggested cropping pattern will be followed and the farming techniques will also be modified. The estimated crop-wise production figures for different clusters can be seen in Appendix V.7. Along with the increase in production, the demand for agricultural produce of different food crops and their production in the tehsil during 1979 and 1984 are shown in Table V.9.

* For a detailed description on the methodology of population projection, see Appendix X.I.

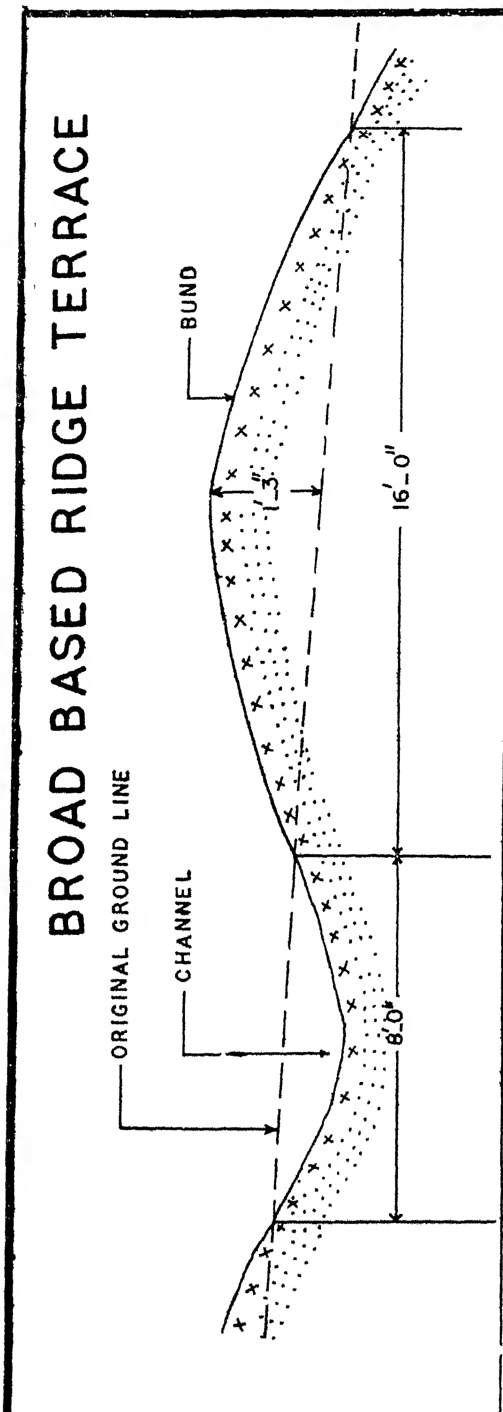


FIG V·9

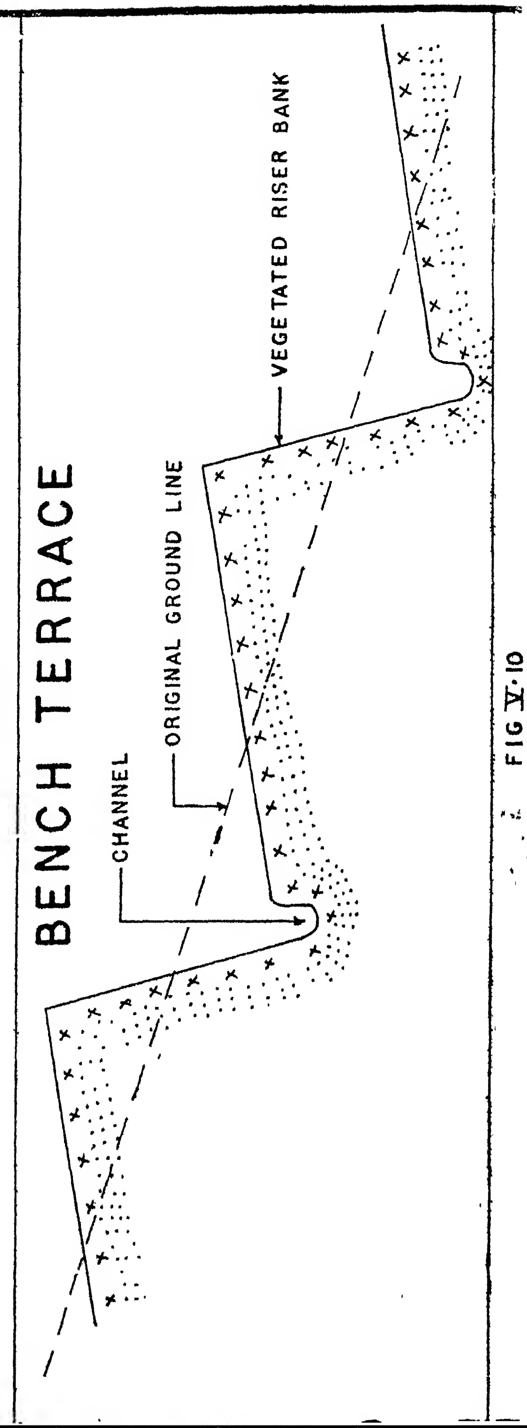


FIG V·10

TABLE V.9 : ESTIMATED PRODUCTION AND CONSUMPTION OF CROPS IN PAURI TEHSIL—1979 AND 1984 (IN TONNES)

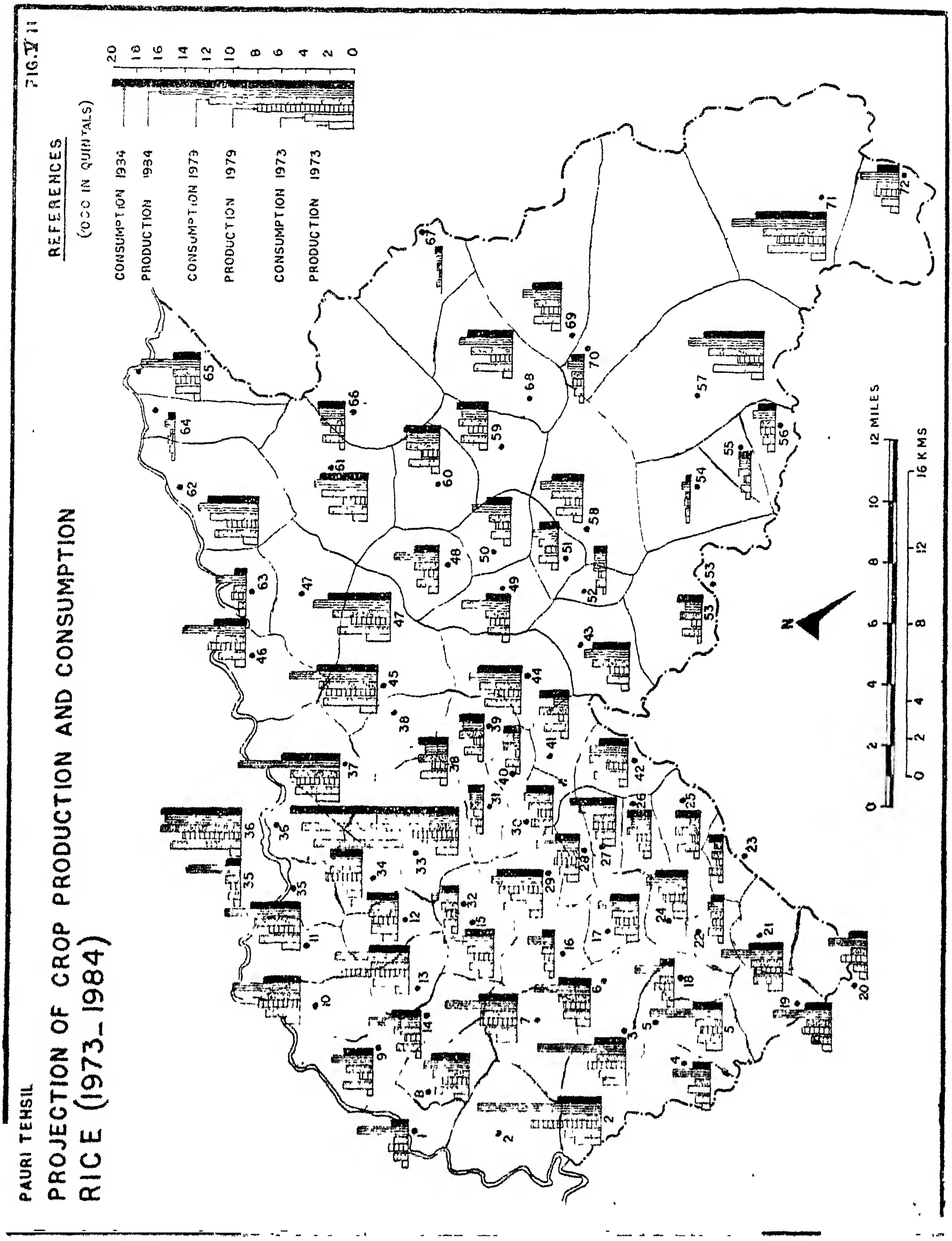
S. No.	Crops	1979			1984		
		Production	Consumption	Surplus/ Deficit	Production	Consumption	Surplus/ Deficit
1.	Rice	13,100	18,100	—5,000	25,800	19,300	+6,500
2.	Wheat	13,100	19,700	—6,600	28,300	21,000	+7,300
3.	Barley	2,600	1,300	+1,300	3,600	1,300	+2,300
4.	Mandua	8,600	6,700	+1,900	14,000	7,100	+6,900
5.	Jhangora	3,000	2,100	+900	4,800	2,200	+2,600
6.	Pulses	1,300	3,600	—2,300	2,400	3,900	—1,500
	Total	41,700	51,500	—9,800	78,900	54,800	+24,100

It will be seen from Table V.9 that in the year 1979, the two major crops, rice and wheat will still be in deficit although the amount of deficit will be marginal namely, 5,000 tonnes for rice and 6,600 tonnes for wheat. It may be recalled from Table V.6 that the deficit for these two crops in 1973 was 10,110 tonnes and 10,180 tonnes, respectively. The deficit by 1979 will, therefore, be reduced considerably. Given the difficult conditions in the tehsil, this should certainly be a remarkable achievement eventhough slight deficits will remain. Pulses, in the year 1979 also show a small deficit, much less than the deficit recorded in 1973. In the case of barley, mandua and jhangora, there will be marginal surpluses in 1979.

The picture is even better in 1984 when all crops, except pulses, show surpluses. Although these surpluses are undoubtedly small, the tehsil will, perhaps for the first time, be self-sufficient in food crops. The estimated surpluses in tonnes in 1984 for rice, wheat, barley, mandua and jhangora are 6,500, 7,300, 2,300, 6,900 and 2,600, respectively.

As mentioned earlier, these estimates are based on a few assumptions. We have assumed that there will be a modest increase in the productivity of crops due to better management practices and more land could be brought under cultivation and also irrigated. Detailed recommendations for achieving these have been made. It should be pointed out that these assumptions are based on the existing limitations and our objective evaluation of the potentialities of this area. It is possible, however, that the productivity of crops may actually be higher than what we have assumed. In that case, the deficits will be much lower in 1979 and surpluses higher in 1984. It may also happen for various reasons, that the proposed land reclamation and irrigation schemes may not be completed according to the time-table suggested here. In that case, the gross production will be lower. It is necessary, therefore, to review the progress of plan implementation every three years or so and revise the estimates accordingly.

Undoubtedly, the cost of implementation will be heavy. One may logically raise the issue of cost-benefit and suggest that the cost is too heavy to make this area barely self-

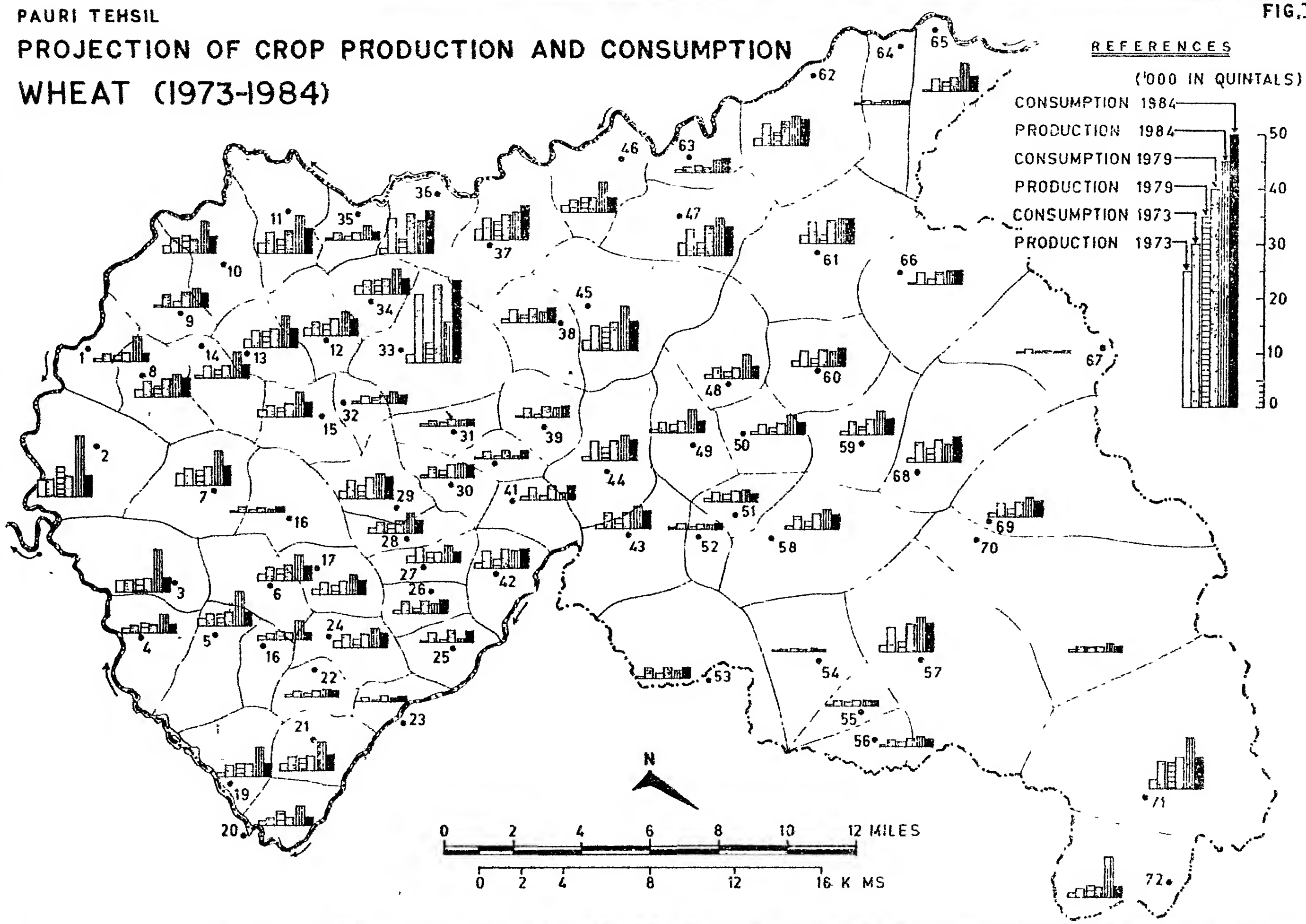

PAURI TEHSIL
PROJECTION OF CROP PRODUCTION AND CONSUMPTION
RICE (1973_1984)
REFERENCES
(000 IN QUINTALS)
CONSUMPTION 1984
PRODUCTION 1984
CONSUMPTION 1979
PRODUCTION 1979
CONSUMPTION 1973
PRODUCTION 1973
12 MILES
16 KMS
N

PAURI TEHSIL

PROJECTION OF CROP PRODUCTION AND CONSUMPTION

WHEAT (1973-1984)

FIG. V.12



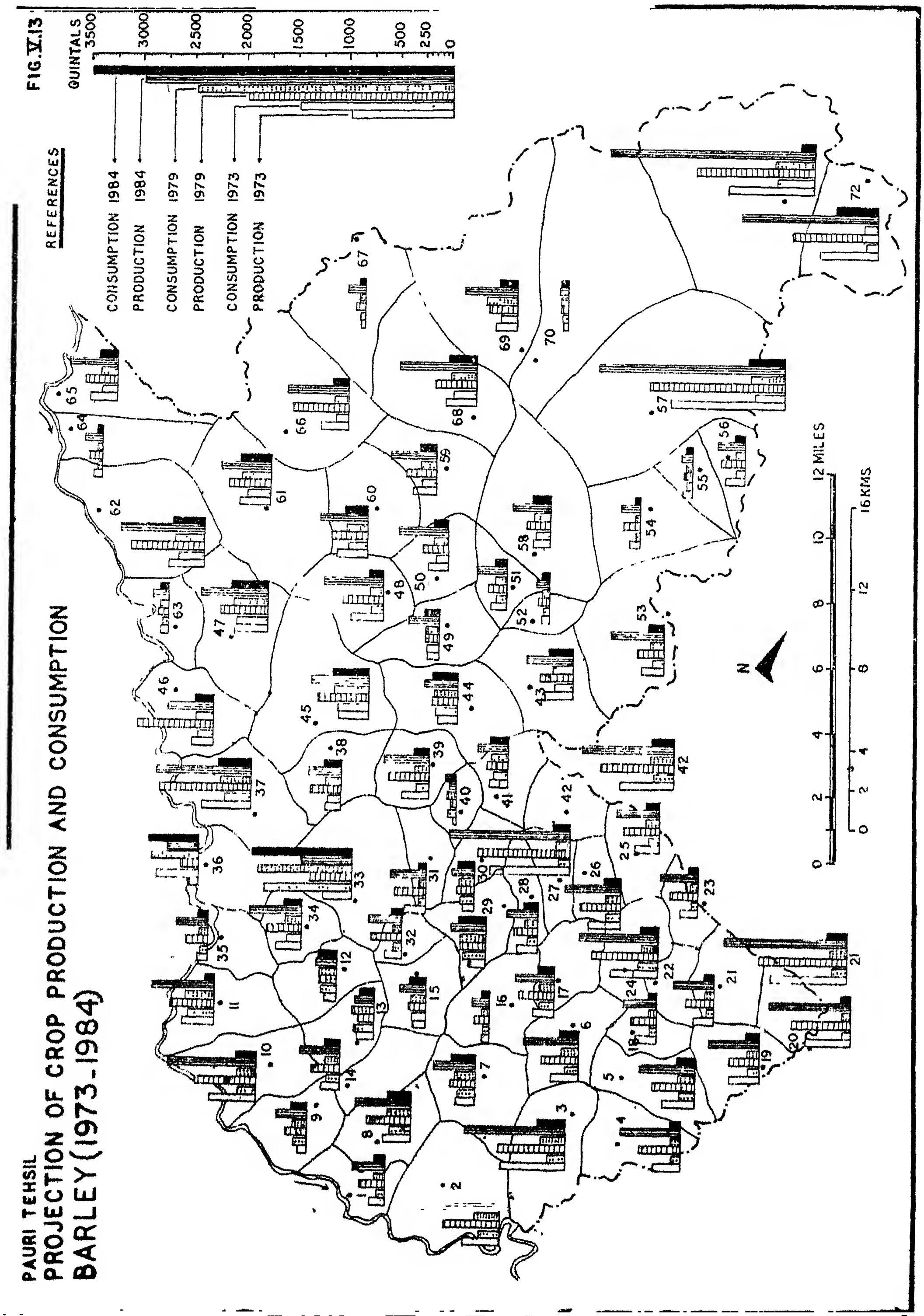


FIG. V.13
PAURI TEHSIL
PROJECTION OF CROP PRODUCTION AND CONSUMPTION
BARLEY (1973-1984)
REFERENCES
CONSUMPTION 1984
PRODUCTION 1984
CONSUMPTION 1979
PRODUCTION 1979
CONSUMPTION 1973
PRODUCTION 1973
QUINTALS
3500
3000
2500
2000
1500
1000
500
250
0
12 MILES
16 KMS
N

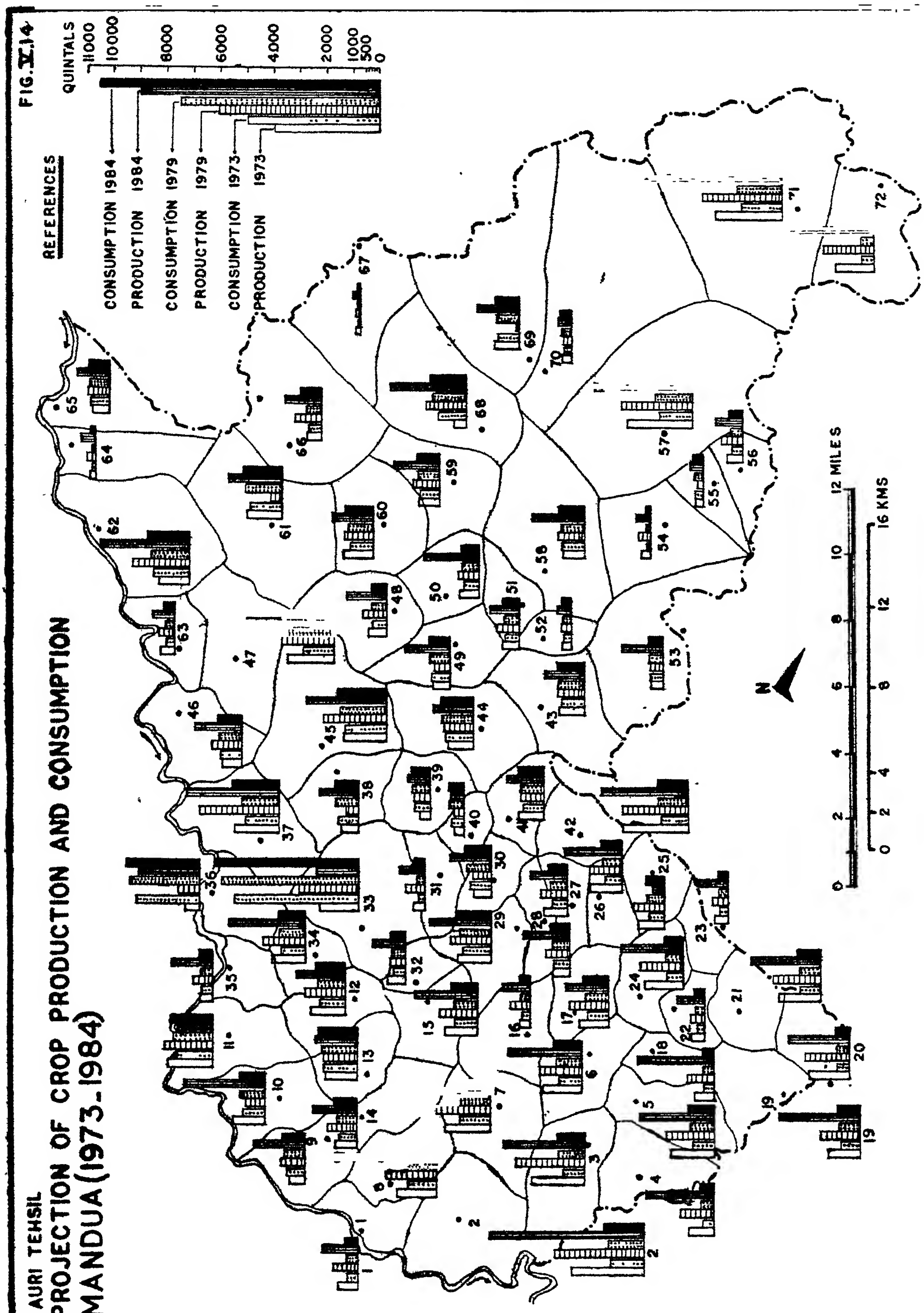
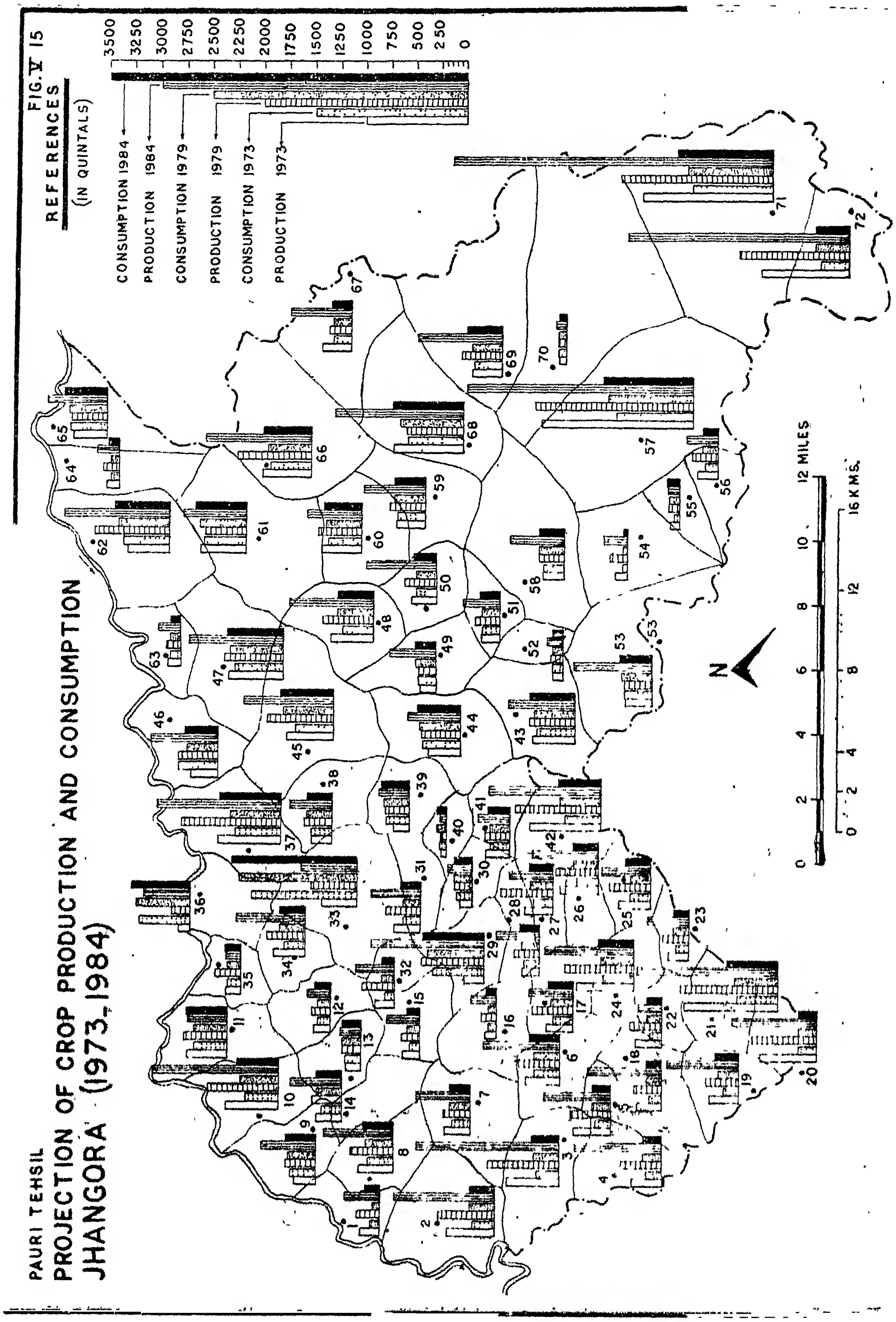


FIG. X.14
AURI TEHSIL
PROJECTION OF CROP PRODUCTION AND CONSUMPTION
MANDUA (1973-1984)
REFERENCES
CONSUMPTION 1984
PRODUCTION 1984
CONSUMPTION 1979
PRODUCTION 1979
CONSUMPTION 1973
PRODUCTION 1973
QUINTALS
11000
10000
8000
6000
4000
2000
1000
500
0
N
12 MILES
16 KMS


PAURI TEHSIL
PROJECTION OF CROP PRODUCTION AND CONSUMPTION
JHANGORA (1973_1984)
FIG. V 15
REFERENCES
(IN QUINTALS)
CONSUMPTION 1984
PRODUCTION 1984
CONSUMPTION 1979
PRODUCTION 1979
CONSUMPTION 1973
PRODUCTION 1973
3500
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
N
12 MILES
16 KMS

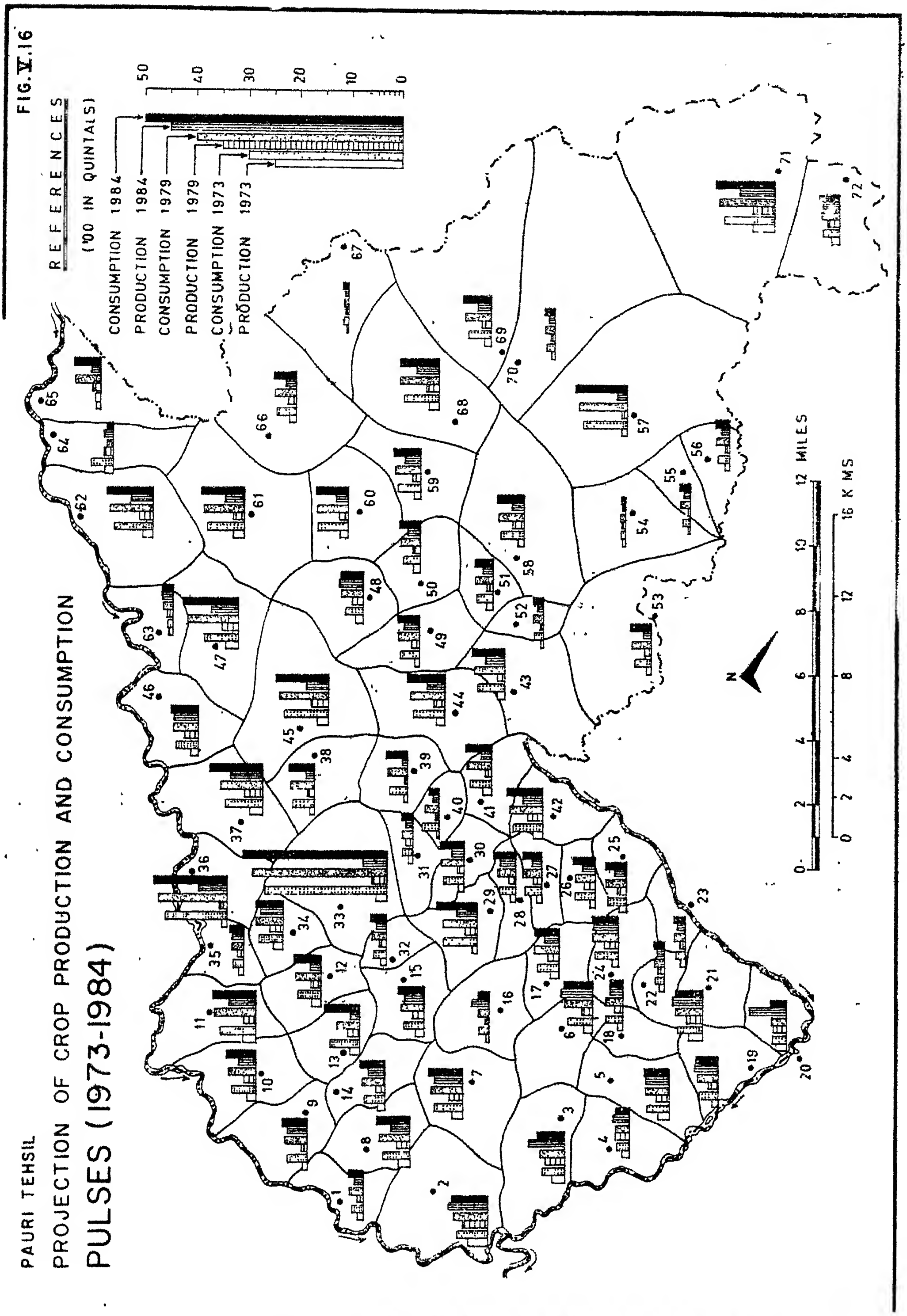


FIG. V.16
PAURI TEHSIL
PROJECTION OF CROP PRODUCTION AND CONSUMPTION
PULSES (1973-1984)
REFERENCES
('00 IN QUINTALS)
CONSUMPTION 1984
PRODUCTION 1984
CONSUMPTION 1979
PRODUCTION 1979
CONSUMPTION 1973
PRODUCTION 1973
50 40 30 20 10 0
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 K MS

sufficient in food. On the surface, one cannot deny the logic of this argument but the matter goes beyond a simple cost-benefit analysis. If it is accepted that the area has to be developed and made at least self-sufficient in food, one cannot but start from agriculture as 84 per cent of the working force is now engaged in it. Our analysis shows that another 13 per cent of the total geographical area can be added to the present small net sown area. The total net sown area can be as much as 33 per cent of the geographical area of the tehsil if recommendations made in this chapter are implemented. It has also been shown that the irrigated areas can be increased from a meagre two and a half per cent to 17 per cent. These are all within the realm of possibility and can be implemented over a period of 10 years. With development, the productivity of crops will also go up and one can sefely predict that in the year 1990, the surpluses estimated for 1984 will also be higher.

In an area like Pauri, the perspective of planning must be very long. The area will not return the investment immediately in the form of heavy surpluses but will take time to become self-sufficient before doing so. The meaning of cost-benefit in these special areas will have to be understood from this point of view. What is implied here is that the development agencies should consider their investments as long-term ones and should not expect immediate returns. Water cess, electricity tariff, input prices will have to be subsidized for sometime until the impact is felt.

Simultaneously, other activities such as horticulture, forestry, sericulture and animal husbandry must be developed as the tehsil cannot depend on agriculture alone. Actually, the topography, climate and rainfall almost guarantee a successful development of these activities within a short period. While moving towards self-sufficiency in food, a large proportion of the manpower currently engaged in agriculture must be diverted to these activities. This will bring about an all-round development of the area and release the stranglehold of subsistence farming on the people. It must be emphasized once again that the diversion of manpower from agriculture cannot be done overnight. Moreover, agriculture must be developed to its fullest potential along with the development of horticulture, forestry, sericulture and animal husbandry. The topography of the land makes distribution of foodgrains in interior villages extremely difficult. This is all the more the reason why the tehsil should plan for self-sufficiency in food production if not for surpluses along with activities which will bring quick cash returns.

The effort for developing agriculture in the tehsil will be hard and long. Aside from physical reclamation of new land and setting up new irrigation projects, a vast network of agricultural infrastructure will have to be planned and implemented. Plan recommendations for setting up of the infrastructure have been made in the next chapter.

CHAPTER VI

PLANNING FOR AN OPTIMUM AGRICULTURAL INFRASTRUCTURE

As mentioned earlier, guidelines framed in the foregoing chapter for the development of agriculture will be effective only if appropriate infrastructure facilities are made available. The agricultural infrastructure includes roads, cooperatives, banks, agencies supplying fertilizers, pesticides, seeds, implements, marketing facilities, etc. An absence of these crucial facilities will inhibit intensive and extensive utilization of the potentials created.

In this chapter, we have assessed the existing conditions before estimating future requirements for the years 1979 and 1984. Locations for different agencies and institutions which will provide seeds, fertilizers, pesticides, credits and marketing facilities have also been recommended.

Seeds. At present a very small area is under the high-yielding variety crops and are mostly limited to demonstration plots. It is expected, however, that by the years 1979 and 1984, more farmers will grow these varieties. We expect a combination of traditional and high-yielding varieties as the future trend of cropping pattern in this area. Seed requirements for different crops in the tehsil have been estimated for 1979 and 1984 for all the clusters (Appendices VI. 1 and VI. 2) The following norms have been used to arrive at the seed requirements for different areas (Table VI.1). These norms have been adapted to the physiographic conditions and soil fertility of the area. The seed to hectare ratio is higher here because of the general poor fertility of the land. The total seed requirement of the tehsil for all the crops in 1979 will be about 39,000 quintals. In 1984, it will be as high as 56,000 quintals. The detailed break-up of the seed requirement for the tehsil has been shown in Table VI.2.

TABLE VI 1 NORMS USED FOR ESTIMATING SEED REQUIREMENT IN PAURI TEHSIL

S. No.	Crop	Seed requirement Kg/hectare
1.	Paddy-rain fed	50
2.	Paddy-irrigated	45
3.	Wheat	90
4.	Barley	80
5.	Mandua	10
6.	Jhangora	8
7.	Pulses	12
8.	Vegetables	6

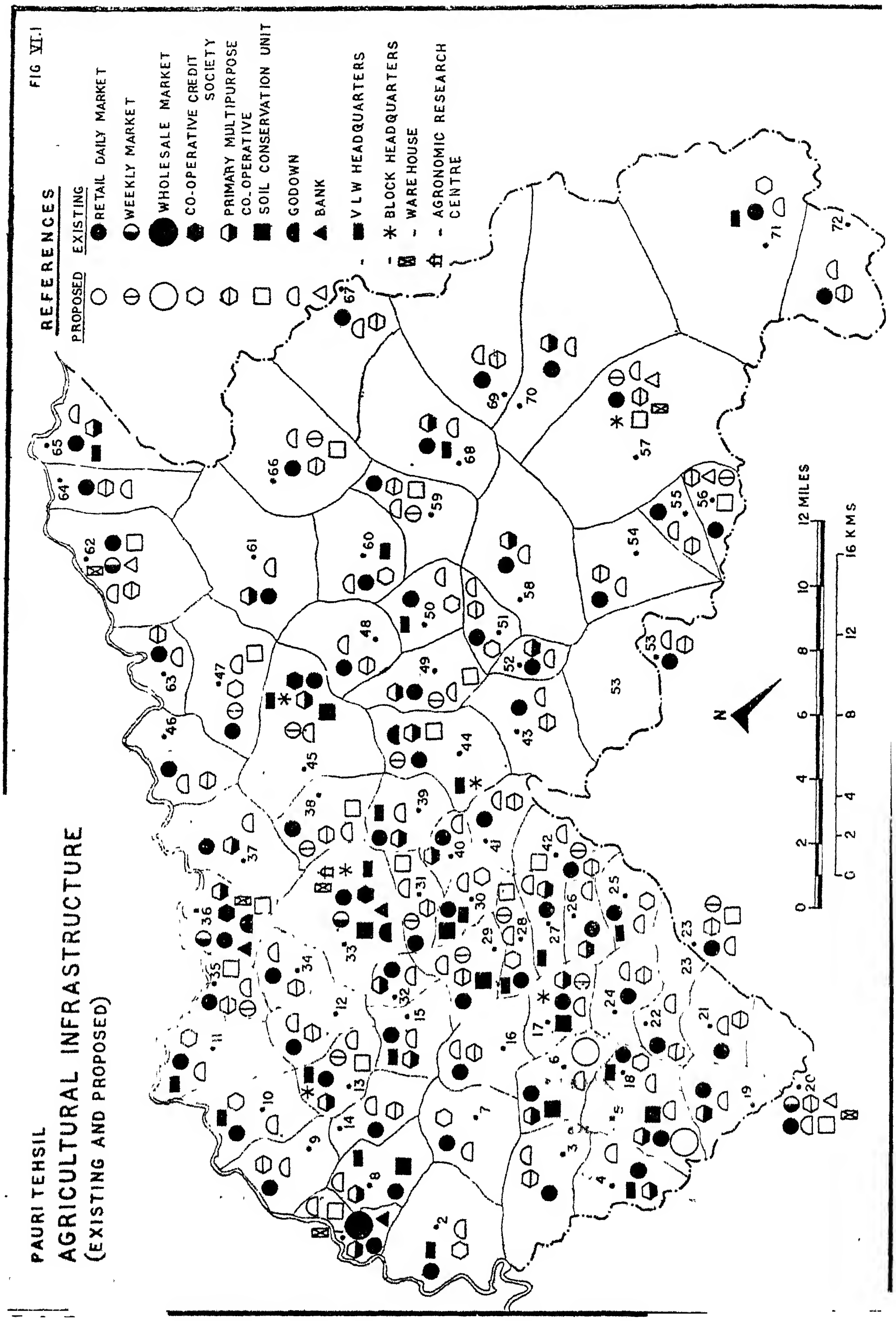


FIG VI.1
PAURI TEHSIL
AGRICULTURAL INFRASTRUCTURE
(EXISTING AND PROPOSED)
REFERENCES
PROPOSED
EXISTING
RETAIL DAILY MARKET
WEEKLY MARKET
WHOLESALE MARKET
CO-OPERATIVE CREDIT SOCIETY
PRIMARY MULTIPURPOSE CO-OPERATIVE
SOIL CONSERVATION UNIT
GODOWN
BANK
V L W HEADQUARTERS
BLOCK HEADQUARTERS
WARE HOUSE
AGRONOMIC RESEARCH CENTRE
N
12 MILES
16 KMS

TABLE VI 2 ESTIMATED SEED REQUIREMENT FOR PAURI TEHSIL IN 1979 AND 1984 (IN QUINTALS)

S No.	Name of the Crop	Seed requirement in 1979	Seed requirement in 1984
1.	Paddy	11,100	13,400
2.	Wheat	18,400	32,000
3	Barley	5,800	6,200
4.	Mandua	2,200	2,900
5.	Jhangora	600	700
6.	Pulses	400	600
7	Vegetables	200	300
	Total	38,700	56,100

There are cooperatives and institutions which supply seeds in the tehsil. The apex cooperatives are located in the block headquarters which supply seeds to other primary multi-purpose cooperative societies. It is through these primary multi-purpose cooperative societies and the offices of the Village-level Workers (VLW) that the farmers get the seeds. There are 60 VLW headquarters and 72 primary multi-purpose cooperative societies in the tehsil. Of these, 18 VLW headquarters and 25 primary multi-purpose cooperative societies are located in central villages. Only six villages have both VLW headquarters and multi-purpose cooperative societies. It is proposed that each *central village* should have either VLW headquarters or a primary multi-purpose cooperative society to meet the requirements of the area. The proposed locations of VLW offices and primary multi-purpose cooperative societies have been tabulated in a later part of this chapter (Table VI.7).

Fertilizer. Eventhough the application of fertilizers at present is extremely low with an average per hectare consumption of less than one Kg.,* it is expected that with the introduction of high-yielding variety crops and an increasing awareness of the farmers to new farming techniques, the demand for fertilizers will also increase. However, it can be said with a certain degree of assurance that fertilizer use in the tehsil will remain modest for some time to come. Various considerations were taken into account before we made this assumption. First, if the existing fertilizer use (which is practically non-existent) is taken as the base, any additional amount does not matter how small, will seem to the farmers as new and unconventional. It will take some time for them to get used to the idea. Secondly, the current petroleum crisis has pushed fertilizer prices sky-high and this factor, more than anything else, is working against a rapid spread of the high-yielding varieties. For marginal and sub-marginal farmers with meagre resources,the high-yielding varieties are too expensive to grow. Mehrotra and Garg have recommended the following dosages of fertilizers (Kgs. per hectare) for the hill areas of U.P.**; Paddy (local)—N: 50 and P: 50; Paddy (HYV)—N : 75, P : 50 and K : 40; Wheat (local)—N : 50, P: 50 and K: 20; Wheat (HYV)—N:100, P : 60 and K : 40. In the light of our earlier discussion, these dosages seem too high. The farmers are most likely to grow high-yielding varieties on a limited scale combined with

* *Area Development Plan*, Pauri Garhwal Area Development Agency, Pauri Garhwal, U.P., 1973, p. 6.

** Mehrotra, O.M. and R.C. Garg, Cropping Pattern for Irrigated Areas in U.P., in *Proceedings of the Symposium on Cropping Patterns in India*, Indian Council of Agricultural Research, New Delhi, 1968.

traditional varieties and they are going to be cautious about fertilizer use. Our recommendation, therefore, is to make use of organic manure such as cow-dung and sheep droppings (by grazing sheep between crops) as much as possible. Based on the above considerations, the following norms have been adopted for estimating future requirements of chemical fertilizers in the tehsil.

TABLE VI.3: ESTIMATED NORMS FOR FERTILIZER REQUIREMENTS OF DIFFERENT CROPS IN PAURI TEHSIL (KGS. PER HECTARE)

S.No.	Name of the Crop	N	P	K
1.	Paddy—Rainfed	25	25	0
2.	Paddy—Irrigated	30	25	20
3.	Wheat—Rainfed	25	25	10
4.	Wheat—Irrigated	35	25	20
5.	Barley	—	—	—
6.	Mandua	—	—	—
7.	Vegetables	—	—	—
8.	Pulses	—	—	—

Total demand for different fertilizers based on the above norms have been estimated for 1979 and 1984 for all the clusters (Appendix VI. 3 and VI. 4). For the whole of the tehsil the estimated fertilizer requirements in 1979 and 1984 can be seen in Table VI.4.

TABLE VI.4 : ESTIMATED REQUIREMENT OF FERTILIZER—PAURI TEHSIL 1979 AND 1984 (IN TONNES)

S. No.	Crops	1979			1984		
		N	P	K	N	P	K
1.	Paddy—Rainfed	343	343	—	366	366	—
2.	Paddy—Irrigated	192	162	128	386	320	206
3.	Wheat—Rainfed	355	355	79	366	366	117
4.	Wheat—Irrigated	226	162	128	452	320	206
	Total	1116	1022	335	1570	1372	529

At present there is no fertilizer factory in the area, neither is there an efficient distribution network for bringing fertilizers from outside and distributing them among the farmers. Fertilizer distribution centres should be located all over the tehsil in such a way that farmers can collect their needs easily from these centres. It is recommended that fertilizer distribution centres be located in all *central villages* for smooth distribution and for making fertilizer use economical for the farmers.

Pesticides. The requirements of pesticides in the tehsil has been assessed on the basis of the cropping pattern. Table VI.5 gives the norms used for estimating the pesticides per hectare.

TABLE VI 5: NORMS FOR PESTICIDE REQUIREMENT OF DIFFERENT CROPS (Per hectare)

PADDY

S. No.	Name of the pest	Parathion	D.D.T.	B.H.C.	Endrin	Aldrin
1.	Paddy stem borer	664.43 lit. (0.025%)	—	—	—	—
2.	Swarming caterpillar	—	—	—	664.43 lit. (0.03%)	— —
3.	Paddy cutworm	—	—	26.0 Kg. (5%)		—
4.	Paddy Bug	—	—	26.0 Kg. (5%)	—	
5.	Rice Grasshopper	—	—	—	—	664 43 lit. (0.02%)
6.	Rice hispa	—	—	26.0 Kg. (5%)	—	—
7.	Paddy grasshopper	—	—	26.0 Kg. (5%)	—	—
8.	Paddy gallfly	—	664.43 lit. (0.25%)	—	—	—

WHEAT AND BARLEY

S.No.	Name of the pest	Endrin	B.H.C.	Nicotine
1.	Stem borer	664.43 lit. (0.03%)	—	—
2.	Termites	—	28.40 Kg. (5%)	—
3.	Wheat alphide	—	—	664.43 lit. (0.05%)
4.	Surface grasshopper	—	28.40 Kg. (5%)	—

MANDUA AND JHANGORA

S.No.	Name of the pest	Endrin	B.H.C.	Nicotine	D.D.T.	Aldrin
1.	Grasshopper	664.43 lit. (0.05%)	—	—	—	—
2.	Swarming catterpillar	—	—	—	664.43 lit. (0.25%)	—
3.	Pink Borer	—	—	—	664.43 lit. (0 25%)	—
4.	Hieroglypims	—	22.33 Kg. (5-10%)	—	—	—
5.	Greasycutworm	—	—	—	—	664.43 lit. (0.03%)
6.	Schizaphis Graminum	—	—	664 43 lit. (0.05%)	—	—

Table VI.5 : (*Contd*)

VEGETABLES				PULSES			
S.No.	Name of the pest	D.D T.	Nicotine	S.No.	Name of the pest	Aldrin	Nicotine
1.	Jassida	664 43 lit. (0 16%)	—	1	Grampodfly	—	664 43 lit. (0 05%)
2.	Aphids	—	664.43 lit. (0.06%)	2.	Greasycutworm	664.43 lit. (0 03%)	—
3.	Epilachra Spp.	664.43 lit. (0 25%)	—				

Percentage figure indicates degree of concentration.

The pesticide requirement for each cluster has been found out for the years 1979 and 1984 (Appendix VI.5 and VI.6). The total required quantity of pesticides in the tehsil during 1979 and 1984 are as follows :

TABLE VI 6: ESTIMATED PESTICIDES REQUIREMENTS FOR PAURI TEHSIL 1979-1984 (*Figures in* '000)

S. No.	Name of Pesticide	Unit	Quantity needed in 1979	Quantity needed in 1984
1.	Endrin	Litres	25.30	33 00
2.	Parathion	Litres	4.50	4 60
3.	Aldrin	Litres	7.00	9.40
4.	D.D.T.	Kgs.	180.20	235 60
5.	Nicotine	Litres	21.00	27 00
6.	B.H.C.	Kgs.	217.20	281.55

From the above table it can be seen that B.H.C. and D.D.T. are required in bulk quantity in the tehsil. The requirement of B.H.C. for 1979 is estimated as 217.2 tonnes and this figure will go up to 281.5 tonnes during 1984. The corresponding figures for D.D.T. will be 180.2 and 235.6 tonnes.

Like fertilizers, pesticides also have to be distributed through agencies and cooperatives. The location of pesticides distribution centres along with fertilizer distribution centres seems to be rational. It is proposed that all *central villages* must be provided with pesticides distribution centres also. At present agencies supplying seeds and fertilizers are distributing pesticides also. It is suggested that this practice should continue in future. Thus, the locations selected for seeds and fertilizer distribution will provide bases for pesticides distribution also.

Agricultural Implements. The present demand for agricultural implements and tools is mostly met by the village blacksmiths and carpenters. Sophisticated agricultural implements are practically non-existent in this area The main reason for this is the inhospitable topography of the land. Because of the danger of landsliding, heavy implements cannot be used. At the same time, the small size of the holdings and their inaccessibility by motorable road does not permit farmers to use modern heavy implements. The real need in this area is for handy tools which can be operated manually.

Among other implements, pump-sets are important. The total capacity of pump-sets required in each cluster and the total for the tehsil during 1979 and 1984 can be seen in Appendix V. 8. These have to be brought from outside the tehsil and distributed in different areas. Besides performing the job of distributing implements, the distribution agencies must also provide repairing and servicing facilities.

The cooperatives and VLW headquarters which are supplying seeds and fertilizers also distribute implements to the farmers. A few more of these facilities have been proposed (Table VI 7) in *central villages* which do not possess either of these at present.

Credit. As the per capita income in the tehsil is only Rs. 135/- as against Rs. 248/- for the state, the marginal farmers are not in a position to meet the expenditure of the required inputs in their farms.† The availability of adequate and timely credit at reasonable rates is one of the important factors in the adoption of improved seeds, fertilizers, pesticides, etc. in this area. Even now, the bulk of the credit requirements is supplied by the traditional moneylenders at high rates of interest. Quite often, farmers have to keep their land fallow due to the absence of necessary credit facilities. In the coming years, the need for credit will be more if new methods of farming are to be introduced in this area.

There are central schemes to help the small and marginal farmers along with agricultural labourers in different parts of the country. If we take into account the criteria* of classifying the farmers into different categories, 69 per cent of the farmers, in the study area, fall in the category of marginal farmers and 26 per cent in the category of small farmers. This indicates how necessary it is to provide credit facilities to the farmers in the tehsil. The magnitude of the credit requirements can be assessed under the following headings :

Construction of ridges, ditches and terracing of agricultural land. To avoid soil erosion and to get a high yield, the farmers have to construct terraces, ridges or ditches whichever is suitable for their land. Since the holdings are very small in size, this work can be done manually and the labour engaged for this work has to be paid; the rate of payment may be nominal in areas of gentle slope but on steep slopes it will be high. Wherever stone bunding and stone riser have to be provided, the expenditure will be substantial and in most cases credit will be required to defray the cost.

Construction of tanks. In areas lying outside the reach of canal or lift irrigation, tanks have to be constructed to store rainwater. This is done by erecting bunds on perennial streams or constructing artificial ditches.

Purchase of seeds, fertilizers, pesticides and implements. Since 95 per cent of the farmers come under the category of small and marginal farmers, they depend mostly on credit to buy seeds, fertilizers, pesticides and implements.

Credit supply agencies/institutions. The following agencies/institutions are currently supplying credit in the tehsil :

1. Block headquarters
2. Primary multi-purpose cooperative societies

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† *Lead Bank Scheme Survey Report on Garhwal District, Uttar Pradesh,* State Bank of India, New Delhi, 1971, p. 2.

* A small farmer is a farmer who is potentially viable to become a surplus producer with improved techniques, inputs, irrigation, etc. He may have a landholding upto 2 hectares. Marginal farmers do not have more than one hectare in irrigated areas. Agricultural labourers earn 50 per cent or more of their income from agricultural wages (Mirchandani, G.G., *Aspects of Agriculture in India,* Allied Publishers, New Delhi, 1973, pp. 227-8.

3. Cooperative credit societies
4. Commercial banks

At present there are six block headquarters located in Kot, Kaljikhal, Pauri, Pabau, Khirsu and Thailisain, which distribute credit through primary multi-purpose cooperatives and cooperative credit societies. As mentioned earlier, there are 72 primary multi-purpose cooperative societies which are concentrated in 48 clusters (Table VI.7) and only 25 of these institutions are actually located in central villages. There are only six cooperative credit societies in the tehsil, four of which are located in central villages. These four central villages are Daduadevi, Pauri, Srinagar and Khirsu. It is estimated that about 60 per cent of the cultivating families are members of these cooperative societies. Banks could also play an important role in providing credit to the farmers. Unfortunately, there are only four banks in the tehsil all of which are located in urban centres, two at Pauri, one at Bahbazar and one at Srinagar.

We cannot expect the banks to be fairly distributed over the tehsil but primary multi-purpose cooperatives and cooperative credit societies have to play a vital role. It is imperative, therefore, that each central village must either have a primary multi-purpose cooperative with credit facilities or a cooperative credit society. It is also proposed that all the *growth centres* must have banking facility (Table VI.7).

Roads. The tehsil is not served by railways. The only means of transportation are roads which are, except for the major roads connecting Srinagar, Pauri and Satpuli, and Pauri and Bahbazar (under construction), of very poor quality. Village roads are completely absent. The important villages are mostly connected with bridle-paths. In the absence of a good road network, the perishable agricultural commodities cannot be marketed in time and the cultivators do not get a good price for their products. In addition, the absence of a reasonably good road network inhibits a free movement of agricultural inputs such as seeds, pesticides, fertilizers, implements, etc. from the distributing centres. A balanced development of this area demands a good road network connecting all dependent villages with their central villages where the agricultural input distribution centres and markets will be located.

Markets. Once harvesting is over, the problem of marketing begins. Although during the deficit period, most of the food crops will be consumed locally, a certain volume of internal trade will always be there. Much of the agricultural produce is perishable and due to poor transport linkages, the villagers are bound to sell their produce at a very nominal price as the chances to take it to organised markets are remote. It will be easy for the co-operatives which will provide agricultural inputs to provide marketing facilities also. Farmers should be able to sell their product at a pre-determined price at these cooperatives. We have already mentioned our recommendations for linking all dependent villages with their central villages where these cooperatives will be located. These links will facilitate the smooth movement of agricultural commodities over the entire tehsil. The present marketing facilities in the tehsil are far from satisfactory. Eventhough almost all the central villages have small retail markets, there are only five wholesale markets in the tehsil. It is proposed that wholesale markets be located in at least all the *service centres*.

Storage facilities. Storage for agricultural inputs and marketable surplus is a major problem in this hilly tehsil. At times, a lot of difficulty arises in making the agricultural inputs available to the farmers in time. This can be solved if there are godowns where seeds, fertilizers, pesticides and implements can be stored and disbursed to the farmers as and when

required. The establishment of godowns in adequate numbers and with due consideration of local needs would be an important step towards increased production and eventual marketing of surplus commodities. It is also necessary to ensure that the services and inputs are made available not just at highly concentrated points but generally over the entire tehsil. For both these purposes, an adequate network of godowns will have to be established. During 1973 godowns were available only in five clusters (Table VI.7). Out of five wholesale markets, only two had warehousing facilities. It is proposed that in almost all the central villages, storing facilities (godowns) should be provided to store the marketable surplus and the inputs required by different clusters. Warehousing facilities (grain banking) should be available at all large wholesale markets. Eventually, all *growth centres* should have them. The capacity of warehouses and godowns in all cases will vary on the basis of the local requirement.

Soil conservation units. At present, there are only eight soil conservation units located in different central villages. Taking into account the large potential area proposed to be cultivated during 1974-84, it is recommended that all the *service centres* must have a soil conservation unit (Table VI.7).

Research and Demonstration. A number of research centres at Chaubattia (district Almora) Bhowati and Manjhara (district Nainital) are conducting research on fruits, rice, wheat, pulses and millets under the sponsorship of ICAR. Pauri tehsil will also be benefited by their work as the research undertaken is mainly for the hill districts of U.P. The study has been useful to find out the high-yielding variety seeds and crop rotation system suitable for this tehsil also. It is felt that there is more scope for work along these lines as the varieties suitable at different altitudes have yet to be recommended. Besides, before the results of research are demonstrated to farmers, it is essential to establish their efficiency under local conditions. The past experience shows that seeds introduced without local trials failed miserably. This brought loss to the farmers and embarrassment to the extension workers. Taking this into account, it is proposed that a full-fledged agronomic research centre be established at Pauri and it should organise demonstrations at the cluster level.

Governmental assistance for the development of agriculture. It has been mentioned before that inspite of the present unsatisfactory combination of circumstances which inhibit agricultural development in the tehsil, efforts must be made to explore possibilities for improving the situation. This is necessary for two reasons. First, unless agriculture moves, other alternative activities cannot be developed. In scarcity, people tend to cling more and more to land thereby reducing agriculture to mere subsistence farming. Currently, 84 per cent of the working force depends on about 20 per cent of the total land area. It will be impossible to divert this manpower to other occupations unless agriculture itself shows signs of improvement. This may sound paradoxical but a certain amount of security among the people is necessary before they will seriously consider other alternatives. The psychology of scarcity is the same everywhere. The logic produced by this psychology is that anything new is financially risky but one can always depend on one's own land for subsistence. The vicious circle created by this logic does not seem to detract people from continuing to do the same thing over again.

Secondly, imported food has to be distributed over rugged terrains without the benefit of roads. The villagers pay a heavy price to buy food from outside. One cannot expect even a reasonable nutritional level under these circumstances. As the cost of food mounts up, there are only two alternative ways of facing the situation. One can let the

existing food situation continue and try to develop horticulture, animal husbandry, etc. or one can make long-term investments in land reclamation, irrigation and soil conservation aiming at self-sufficiency in food. The cost is heavy in either case. In the former case, the cost is passed on to the impoverished villager who has to pay higher prices for imported food. In the second case, the government assumes the responsibility of paying the cost of land reclamation, etc. as a long-term investment.

The whole purpose of this planning exercise is based on the assumption that the government will assume this responsibility. It is not only a question of paying construction costs but also of providing subsidies on prices of agricultural inputs, water cess, electricity tariffs and interest rates for a long time.

Fortunately, both the Government of India and the State Governments are sensitive to the problems of backward areas and hill areas in particular. Several schemes for assisting backward areas and hill areas are in operation in various parts of the country. Various agencies have been appointed for implementing these schemes.* A special hill area development agency has been formed for Pauri tehsil which has already started functioning on a selective basis.

The recommendations made in this and other chapters of this report for investments in various development programmes, are for the consideration of these agencies. We also recommend that the Government of India and the State Governments declare hill areas like the present study area as a special long-term liability of the government until things begin to improve. Aside from subsidies, the government must schedule loan repayments generously so that the people of these areas have a genuine opportunity for developing their own economy. Without such assistance, it will be impossible for the people of this hill area to attain even a semblance of civilized living, the goal set before the entire country. It may be noticed from our recommendations that we have not suggested cash reliefs, doles or *ad hoc* employment programmes just to provide jobs. Our recommendations are for the government to take direct action for mitigating problems which involve large-scale investment and cannot be done by individuals. Once these problems are removed, the helping hand of the government through subsidies and lower tariffs would certainly provide enough incentives among the hardworking people of this area to take full advantage of the opportunities offered to them.

It may be noticed in Table VI.7 that two types of services have been recommended at various locations. The first type such as distribution of fertilizers, seeds, pesticides, implements, credit and the provision of marketing facilities to be organised through block headquarters, VLW headquarters, primary multi-purpose cooperatives and cooperative credit societies, require direct intervention on the part of the government. Implementation of these programmes need not wait and should be put into action as early as possible.

The second type of services such as weekly and retail markets will require entrepreneurship from the people. The development agencies can only provide sites, electricity

* For a detailed description of the various schemes and agencies for the improvement of the poorer sections of the population such as small farmers, marginal farmers and agricultural labourers, and for the development of backward areas such as drought-prone areas and hill areas, see Planning Commission, Government of India, *Fourth Five-year Plan* 1969-74 and *Fifth Five-year Plan* 1974-79; Shah, S.M. "Sectoral Planning in India", and Menon P.K.J., "Spheres of Rural Development Planning in the States' Five-year Plans", in Sen, Lalit K. (ed.), *Readings on Micro-level Planning and Rural Growth Centres*, NICD, Hyderabad, 1972; and Khan, W. (ed.), *Papers and Proceedings of the Workshop-cum-Seminar on Rural Institutions and Agricultural Development*, NICD, Hyderabad, 1972.

water and roads for attracting local entrepreneurship. If some initial economic incentives such as a low establishment tax, nominal water and electricity tariffs and credit with low interest are offered, then private entrepreneurs are likely to come forward within a short period.

To summarize the purpose of this chapter very briefly, the guidelines formulated in the previous chapter for agricultural development in the study area will be effective only if a network of institutions providing strong support to the agricultural activities is established. The present chapter has made detailed recommendations on the types of institutions that will be required for this purpose and their functions.

Table VI.7 summarizes the recommendations made in this chapter.

TABLE VI 7 EXISTING AND PROPOSED AGRICULTURAL INFRASTRUCTURE IN PAURI TEHSIL

S. No.	Central villages/ Service centres/ Growth centres/	Existing functions	Proposed functions
1	2	3	4
1.	Bahbazar	Primary multi-purpose cooperative, retail daily market, wholesale market, bank.	Godown, warehouse, soil conservation unit.
2.	Ghindwara	VLW headquarters, retail daily market.	Cooperative credit society, godown.
3.	Baganikhal	Retail daily market.	Primary multi-purpose co-operative, godown.
4.	Diusi	VLW headquarters, primary multi-purpose cooperative, retail daily market.	Godown.
5.	Ghandiyal	Primary multi-purpose cooperative, retail daily market, soil conservation unit.	Wholesale market, godown.
6.	Kanskhet	Primary multi-purpose cooperative, retail daily market, soil conservation unit.	Wholesale market, godown.
7.	Mahsain	Retail daily market.	Primary multi-purpose cooperative, godown.
8.	Safdarkhal	VLW headquarters, primary multi-purpose cooperative, retail daily market, soil conservation unit.	Godown.
9.	Kamalpur	Retail daily market.	Primary multi-purpose co-operative, godown.
10.	Jumlakhal	VLW headquarters, retail daily market.	Cooperative credit society, godown.

TABLE VI.7: (*Contd.*).

1	2	3	4
11.	Delchunnri	VLW headquarters, retail daily market.	Cooperative credit society, godown
12.	Khandiunsain	Retail daily market.	Primary multi-purpose cooperative, godown.
13.	Kot	Block headquarters, VLW headquarters, primary multi-purpose cooperative, retail daily market.	Godown, soil conservation unit
14.	Kholachaunri	Retail daily market.	Primary multi-purpose cooperative, godown.
15	Iwali	VLW headquarters, primary multi-purpose cooperative, retail daily market.	Godown.
16.	Adwani	Retail daily market.	Primary multi-purpose cooperative, godown.
17.	Kaljikhal	Block headquarters, primary multi-purpose cooperative, soil conservation unit, retail market.	Godown.
18.	Saknikhat	VLW headquarters, retail daily market	Cooperative credit society, godown
19.	Banghat	Primary multi-purpose cooperative, retail daily market.	Godown.
20.	Satpuli	Retail daily market, weekly market.	Primary multi-purpose cooperative, godown, soil conservation unit, bank, warehouse.
21.	Kandarpani	Retail daily market.	Primary multi-purpose cooperative, godown.
22.	Mawadhar	Retail daily market.	Primary multi-purpose cooperative, godown.
23.	Patisain	Retail daily market.	Primary multi-purpose cooperative, weekly market, godown, soil conservation unit.
24.	Mundneshwar	Retail daily market.	Primary multi-purpose cooperative, godown.
25.	Pipalipani	VLW headquarters, retail daily market.	Cooperative credit society, godown.
26.	Jakhati	Primary multi-purpose cooperative, retail daily market.	Godown.

TABLE VI.7: (*Contd.*).

1	2	3	4
27.	Agrora	VLW headquarters, primary multi-purpose cooperative, retail daily market.	Godown.
28.	Paidul	VLW headquarters, retail daily market.	Cooperative credit society, godown, soil conservation unit.
29.	Parsundakhal	Retail daily market, soil conservation unit.	Primary multi-purpose cooperative, godown.
30.	Kandara	VLW headquarters. soil conservation, retail daily market.	Cooperative credit society, godown.
31.	Bubakhal	Retail daily market.	Primary multi-purpose cooperative, godown, soil conservation unit.
32.	Daduadevi	Primary multi-purpose cooperative, retail daily market.	Godown.
33.	Pauri	Block headquarters, VLW headquarters, Cooperative credit society, retail daily market, soil conservation unit, godown, bank.	Agronomic research centre, warehouse.
34.	Kyark	Retail daily market.	Primary multi-purpose cooperative, godown.
35.	Kirtinagar	Retail daily market.	Primary multi-purpose cooperative, godown, soil conservation unit.
36.	Srinagar	Primary multi-purpose cooperative, cooperative credit society, retail daily market, godown, bank.	Soil conservation unit, warehouse.
37.	Sumari	Primary multi-purpose cooperative, retail daily market.	Godown.
38.	Chaubatiakhal	Retail daily market.	Primary multi-purpose cooperative, weekly market, godown, soil conservation unit.
39.	Choprium	VLW headquarters, primary multi-purpose cooperative, retail daily market.	Godown.
40.	Bhainswara	Primary multi-purpose cooperative, retail daily market.	Godown.
41.	Sikukhal	Retail daily market.	Primary multi-purpose cooperative, godown.

TABLE VI.7: (*Contd.*).

1	2	3	4
42.	Pokrikhet	Retail daily market.	Primary multi-purpose cooperative, weekly market, godown, soil conservation unit.
43.	Champeshwar	Retail daily market.	Primary multi-purpose cooperative, godown.
44	Pabau	Block headquarters, VLW headquarters, primary multi-purpose cooperative, retail daily market, godown,	Weekly market, soil conservation unit.
45.	Khirsu	Block headquarters, VLW headquarters, primary multi-purpose cooperative, cooperative credit society, retail daily market, soil conservation unit.	Weekly market, godown.
46.	Bhattisera	Retail daily market.	Primary multi-purpose cooperative, godown.
47.	Kherakhal	Retail daily market.	Primary multi-purpose cooperative, weekly market, godown, soil conservation unit.
48.	Mailisain	Retail daily market.	Primary multi-purpose cooperative, godown.
49.	Chifalghat	Primary multi-purpose cooperative, retail daily market.	Weekly market, godown, soil conservation unit.
50.	Sankarsain	VLW headquarters, retail daily market.	Cooperative credit society, godown.
51.	Cholusain	Retail daily market	Primary multi-purpose cooperative, godown.
52.	Bajwar	Primary multi-purpose cooperative, retail daily market.	Godown.
53.	Ramdeval	Retail daily market.	Primary multi-purpose cooperative, godown.
54.	Chaunrikhal	Retail daily market.	Primary multi-purpose cooperative, godown.
55.	Pokhri	Retail daily market.	Primary multi-purpose cooperative, godown.
56.	Bhira	Retail daily market.	Primary multi-purpose cooperative, weekly market, godown, soil conservation unit.

TABLE VI.7: (*Contd.*)

1	2	3	4
57.	Thailisain	Block headquarters, retail daily market.	Primary multi-purpose cooperative weekly market, godown, soil conservation unit, bank, warehouse.
58	Nautha	Primary multi-purpose cooperative, retail daily market.	Godown.
59.	Chakisain	Retail daily market.	Primary multi-purpose cooperative, weekly market. godown, soil conservation unit.
60.	Paithani	VLW headquarters, retail daily market.	Cooperative credit society, godown.
61.	Barsuri	Primary multi-purpose cooperative, retail daily market.	Godown.
62.	Rudraprayag	Retail daily market, weekly market	Primary multi-purpose cooperative, godown, soil conservation unit, bank, warehouse.
63.	Khankora	Retail daily market.	Primary multi-purpose cooperative, godown.
64	Sumerpur	Retail daily market.	Primary multi-purpose cooperative, godown.
65.	Ratura	VLW headquarters, primary multi-purpose cooperative, retail daily market.	Godown.
66.	Molkakhal	Retail daily market.	Primary multi-purpose cooperative, weekly market, godown, soil conservation unit.
67.	Gidokhal	Retail daily market.	Primary multi-purpose cooperative, godown.
68.	Chaunra	VLW headquarters, primary multi-purpose cooperative, retail daily market.	Godown.
69.	Gadoli	Retail daily market.	Primary multi-purpose cooperative, godown.
70.	Tarpali	Primary multi-purpose cooperative, retail daily market.	Godown.
71.	Bungidhar	VLW headquarters, retail daily market.	Cooperative credit society, godown.
72.	Samoya	Retail daily market.	Primary multi-purpose cooperative, godown.

CHAPTER VII

PLANNING FOR THE DEVELOPMENT OF HORTICULTURE, FORESTRY AND SERICULTURE

In the two previous chapters on agricultural development and agricultural infrastructure we have examined the agricultural potential of the study area and the institutional infrastructure that will be required for utilizing this potential. We concluded that the area which is currently deficit in foodgrains can become self-sufficient provided a full utilization of the potential resources is made and a supporting infrastructure is established. Although the initial cost will be heavy, we recommended a long-term investment in agriculture for making the study area self-sufficient and even marginally surplus in food as the cost of importing food from outside and distributing it over an inhospitable terrain would be even higher.

On the other hand, it is necessary to emphasize that the future prosperity of this area lies not in its agriculture but in vast natural resources in the form of forests and fruit trees. Although none of these sectors is fully organized at present for making a positive contribution to the prosperity of the area, the potentiality for doing so is definitely there. The purpose of this chapter is to examine the horticultural, sylvicultural and sericultural potentialities of this area and to make recommendations for the development of these sectors. Recommendations for the development of animal husbandry have been made in the next chapter.

HORTICULTURE

The topography of the land which has inhibited agricultural development in the tehsil does not pose any problem for horticulture. Hill slopes which cannot be utilized for food crops, provide an ideal base with the right amount of drainage for fruit trees. Actually planting fruit trees on the slopes will prevent one of the most serious problems of the area, soil erosion. The soil and climate of the area are also ideal for large-scale fruit growing. Over and above the favourable natural factors, the per acre returns from well-maintained orchards are better than field crops (see Table VII.3). Also, a fruit grower unlike his counterpart in agriculture, remains engaged throughout the year. For a developing region, horticulture promises the development of several ancilliary industries such as preservation, dehydration, refrigeration and transport. In short, the economy of the tehsil can be considerably revitalized by intensive cultivation of fruits.

Present State of Horticulture in the Tehsil

At present, the area under fruit cultivation in the tehsil is extremely small. Table VII.1 shows the area under different fruit trees in the tehsil in 1973.

Table VII.1 indicates that the total area under horticulture is 3,000 hectares which is only 1.36 per cent of the total geographical area of the tehsil. Area-wise, apples are the most important fruits in the tehsil followed by lemons and mangoes. The orchards are unevenly distributed over the tehsil. Some of them are located in small patches along

TABLE VII 1 : AREA UNDER DIFFERENT FRUITS IN PAURI TEHSIL—1973

S. No.	Name of Fruit	Area in Hectares	Percentage to total area
1.	Apple	1,118	37.26
2.	Peach	201	6 70
3.	Pear	177	5 90
4	Plum	144	4 80
5	Apricot	151	5 03
6	Walnut	199	6 37
7.	Mango	380	12 67
8.	Guava	200	6.67
9.	Lemon	383	12.77
10.	Litchi	55	1 83
	Total	3,000	100 00

Source : District Horticultural Office, Pauri.

Pauri-Srinagar, Pauri-Satpuli and Pauri-Bahbazar roads. A large proportion of the orchards are located along ridges away from main roads. In addition, there are a few fruit gardens and nurseries. Important among these are the gardens located at Bharsar, Khirsu, Srinagar, Khandiausain and Khaproli The area under Bharsar garden is the largest, 194.374 hectares. The major market centres for fruits in the tehsil are located at Pauri, Srinagar and Satpuli. Fruits from the surrounding areas are collected in these centres and transported outside the district. Warehousing facilities are available in Pauri and Srinagar. Mobile plant protection units centred at Srinagar, Pauri, Khandisain, Kaskhet, Thailisain and Pabau provide assistance to the fruit growers. The Horticulture Research Centre at Srinagar conducts agronomic studies and soil analysis.

Average yield and production of various fruits are shown in Table VII.2.

TABLE VII 2 : PRODUCTION OF FRUITS—PAURI TEHSIL 1973

S. No.	Name of Fruit	Average yield tons/hectares	Production in tonnes
1.	Mango	2.60	988
2.	Guava	3.10	620
3.	Lemon	3.00	1,149
4.	Apple	1.90	2,124
5.	Peach	1.90	382
6.	Pear	2.10	372
7.	Plum	2.25	324
8.	Walnut	2.25	430
9.	Apricot	1.875	284
10.	Litchi	1.25	69
	Total		6,742

Source : District Horticultural Office, Pauri.

The above figures are for production at site. Only a small proportion of this is exported outside the district, mainly because of the absence of proper roads, lack of storage facilities and refrigerated vehicles. The yield per hectare can be considerably increased if more information on improved practices is made available to the farmers and irrigation is provided for specific fruit trees. For most of the fruit types, the rainfall is enough.

Problems of Horticulture Development

Successful horticulture includes various stages of operation. Starting from planting trees, their care, harvesting, packing, storing, transporting, processing and delivering the fruits to the consumer in the form and at the time he needs them, all go towards making horticulture a profitable venture. Many growers in the tehsil leave the subsequent operations of harvesting and distribution to middlemen who make disproportionate profits by taking advantage of the growers' handicaps.

Many fruit growing areas are not accessible by motorable roads. Even the government fruit garden at Barsar, which is the largest in the tehsil, was not connected by all weather motorable road until recently. The consumer centres are far away from the centres of production and there is no facility for refrigerated transportation.

Lack of storage facilities present another bottleneck. A large quantity of fruits after their removal from the trees perish under ordinary atmospheric temperature and humidity and cannot be stored even for a few days without serious deterioration. Cold storage plants which can extend the sale-period of fruits are not available in the study area. This results in unfair prices to the growers as they dump the entire quantity of fruits during the yielding seasons.

The absence of fruit processing and preservation industries in the tehsil is also a discouraging factor. Fruit preservation enables growers to make fruits available not only during off seasons but also in places which are too far to receive fresh fruits or where fruits are not grown. Inferior fruits which do not normally find a place on the table because of some inherent defects can be economically utilized by fruit processing industries. This way the growers can make a profit even on their inferior fruits which normally get thrown away or fetch very low prices in the markets.

Potentialities for Horticultural Development

Horticulture provides a high rate of return as compared with agriculture and fosetry. This is true in this tehsil also in spite of the poor facilities available. Comparative values of production per hectare of important agricultural crops and fruits in the tehsil are given in Table VII.3.*

It can be seen from Table VII.3 that the average value of production per hectare of horticulture is more than 3 times that of agriculture. It can also be seen from the table that some fruits like apples and plums fetch very high prices. Considering its comparative profitability and suitability for this area, the land under horticulture is extremely meagre in the tehsil. Obviously, the high perishability of fruits in the absence of cold storage and marketing facilities, makes fruit growing a risky proposition for the farmers. It is also obvious that if some of these problems are removed, horticulture will become a much more attractive occupation in the tehsil than it is now. Since the land area under horticulture is extremely small at present, it is necessary to identify potential areas where horticulture can be profitably developed.

* The prices of foodgrains and fruits reported were the wholesale market prices in Pauri during 1973.

TABLE VII.3 : VALUE OF PRODUCTION PER HECTARE FOR SELECTED CROPS AND FRUITS IN PAURI TEHSIL—1973

Agriculture		Horticulture	
Name of Crop	Value/hectare (in rupees)	Name of Fruit	Value/hectare (in rupees)
Paddy	2,304	Apple	8,400
Wheat	1,815	Peach	2,810
Barley	1,140	Pear	6,300
Maize	850	Plum	6,800
Mandua	640	Apricot	2,800
Jhangora	480	Walnut	6,550
Pulses	1,875	Mango	5,200
Oilseeds	1,310	Guava	4,670
		Lemon	3,920
		Litchi	1,870
Average	1,300		4,932

Whatever has been said so far should make it clear that the tehsil provides practically a virgin area for horticultural development. Theoretically speaking, fruit trees can be grown on all lands which are not already under agriculture or forests or earmarked for them. However, while planning for horticulture, it is necessary to be careful about selecting sites. We have already discussed some of the practical limitations of the area and allowances have to be made for these.

Identification of Areas Suitable for Horticulture

The selection of sites for horticulture and for specific fruit trees should depend upon a number of factors such as climate, altitude, soil,accessibility and nearness to market centres. In selecting potential areas for the extension of horticulture in the tehsil, all of these factors were taken into account. Brief discussions of these factors are presented below.

Climate and Altitude. Though Pauri falls on the sub-tropical zone, a large variety of fruits, both tropical and temperate, can be grown in the tehsil due to the varying altitude and climatic conditions. The following types of fruits can be grown in the tehsil :(1) temperate fruits, (2) sub-tropical fruits and (3) tropical fruits. The climatic and altitude requirements are as follows :

Temperate fruits. This class of fruits grows in areas where the temperature falls below freezing point during winter. During the cold season, the trees shed their leaves and enter into rest period. For breaking this rest period, a definite chilling period is required. These fruits can be divided further by elevation of the land. The former ranging from 1,500-2,500 metres above sea level and latter at 1,200 metres above sea level. Fruits like apple, pear, walnut, almund and cherry can be grown successfully at 1,500-2,500 metres above sea level. On the other hand, fruits like peach, plum, apricot and strawberry can be grown at a lower elevation. Some varieties of peach and plum which have low chilling requirements can be grown at lower elevations.

Sub-tropical fruits. Fruits such as lime, lemon, litchi and guava grow in areas where the temperature may occassionally go below freezing point but not as a rule, below 25° F. They are suitable for plain areas where the climate is hot and dry and winter is comparatively less cold. They grow in isolated places or where the topography offers good air and drainge, such as areas adjoining low hills.

Tropical fruits. Hot and humid summers, mild winters and good rains are required for tropical fruits. Mango and banana are the best examples of tropical fruits.

Soil

Along with surface soil, the nature of the sub-soil has to be carefully considered for raising fruit trees. As the roots of the trees generally reach down to 2 metres, the condition of soil at a depth of 2 metres should be examined. Porous, aerated and deep soils should be preferred for fruit culture. Soils of uniform texture, 2 metres deep with 3 metres deep water table should be considered ideal for growing fruit trees.

Accessibility

Once climatic and altitudinal screening is done, the next priority should be given to those sites which are already connected by motorable road. Areas ideal for horticulture but without road links should be selected only if roads can be constructed as a part of the development plan for horticulture.

Marketing and Processing Centre

For reasons mentioned earlier, sites selected for horticulture should not be too far from market centres. At present, Pauri, Srinagar and Satpuli are the major collection and distribution centres of fruits. If new market centres evenly spaced over the tehsil are established then a much larger area can be brought under horticulture within the tributary zones of these centres. Proposals for new viable market centres have already been made in the previous chapter (see Table VI.7). The relevance of these proposed market centres for fruit marketing has been discussed later in this chapter.

Selection of Sites

Sites for horticulture must be selected in areas which are not already reserved for agriculture. It is our recommendation not to disturb the agricultural land in spite of its lower return per hectare as compared with horticulture for reasons mentioned earlier. As far as possible, land should be chosen in between existing and proposed agricultural land and the forest areas. Lands with more than 30 per cent slope which are not suitable for agriculture and are also not under forests should be the most ideal sites for horticulture. If horticulture has to be developed on a commercial scale, care should also be taken for providing large stretches of lands which are not fragmented by settlements. This puts an additional restriction to the selection of eligible sites.

Giving due weightage to each of the above factors, an area of 8,000 hectares has been proposed. Out of this, 4,160 hectares will have to be developed by government agencies and the remaining area by private entrepreneurs. When the government orchards start bearing fruits, their maintenance should be handed over to local people on no profit no loss basis. Table VII.4 shows the proposed locations of orchards to be developed by government agencies. Location of orchards to be developed by private individuals have not been indicated in table as this will be in the form of small areas of 2-3 hectares dispersed over the entire tehsil.

TABLE VII.4 : LOCATION AND AREA OF PROPOSED GOVERNMENT ORCHARDS IN PAURI TEHSIL

S.No.	Cluster	Area in Hectares
1.	Kansket	60.00
2.	Khandiunsain	285.00
3.	Kyark	165.00
4.	Pauri	385.00
5.	Kalgikhal	300.00
6.	Patisain	120.00
7.	Mundneshwar	355.00
8.	Srinagar	390.00
9.	Sumari	205.00
10.	Khirsu	625.00
11.	Thailisain	285.00
12.	Nautha	975.00
		4,150.00

A phased programme can be followed for the development of the area chosen for horticulture. The total area under horticulture by 1984 will be 11,000 hectares (Table VII.5) including the existing area. Development programmes should be taken up in such a way that a minimum of 400 hectares is brought under horticulture in the first year (1974) of the planning period. Further additions should be made on an incremental basis so that every year, an area of 100 hectares is added to the previous year's area during the first five years. Thereafter the development should be at a constant rate of 1,000 hectares per annum. As emphasized earlier, all development work for horticulture must be preceded and complemented by construction of link roads connecting the orchards with main roads and/or with the nearest market centres, and by soil conservation measures.

The proposed area under different species of fruits in the successive years from 1974 to 1984 is shown in Table VII.6. The break-up of the area for different fruits have been made according to their commercial importance. The minimum period required to bear fruit for trees is 5 years and in the case of apples and pears it is 7 years. The estimated production of fruits in 1979 and 1984 are tabulated below.

In the above estimate it is assumed that the production during 1979 will be only from fruit trees planted up to 1973. The yield from the area additionally brought under horticulture according to our proposals will start from 1980 onwards. The yield for the year 1984 has been estimated for all orchards which will be operating in the 1979. The total fruit production during 1979 and 1984 are estimated as 15,812 and 24,258 tonnes. No reliable data are available on the local consumption of fruits. We have, therefore, estimated the local consumption on the basis of the projected population figures and the minimum daily requirement* of fruits for balanced diet. The local demands for fruits for the years 1979 and 1984 are estimated as 4,750 and 5,100 tonnes, respectively.

Even after the establishment of fruit preservation industries a small proportion (2 to 5 per cent) will be wasted at different stages of marketing. Due to external demand, a good quantity will also be exported outside the tehsil. Making allowances for all of these,

* Dr. Shyam Singh has recommended a minimum consumption of 57 gms. of fruits per person per day. See Singh, S. *et al*, *Fruit Culture in India*, ICAR, New Delhi, 1963.

TABLE VII.5 : EXISTING AND PROPOSED AREA IN HECTARES UNDER HORTICULTURE 1974–1984

S.No.	Name of fruit	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1.	Apple	1575.00	1775.00	2025 00	2325.00	2675.00	3075.00	3575.00	4075 00	4575.00	4744.00	4744.00
2.	Peaches	250.00	270.00	295.00	325.00	360.00	399.00	449 00	498.00	548.00	597.00	597.00
3.	Pear	120.00	238.00	260.00	286.00	317.00	352.00	391.00	439.00	483.00	527.00	527 00
4.	Plum	180.00	194.00	212.00	233.00	255 00	283.00	319.00	354.00	390 00	425.00	425.00
5.	Apricot	185.00	201.00	219.00	241.00	268.00	298.00	335.00	372.00	409 00	800 00	800 00
6.	Walnut	248.00	267.00	292.00	322.00	357.00	396.00	445.00	495.00	544 00	594 00	594.00
7.	Mango	517.00	558.00	609.00	671.00	744.00	827.00	929.00	1033.00	1136 00	1182 00	1182.00
8.	Guava	289.00	311.00	340.00	373.00	413.00	459.00	516 00	573.00	629 00	685 00	685 00
9.	Lemon	555.00	599.00	654.00	720.00	796.00	884.00	994 00	1103.00	1213 00	1258 00	1258 00
10.	Litchi	81.00	87.00	94.00	104.00	115.00	127.00	142.00	158 00	173 00	188 00	188.00
	Total	4101.00	4500.00	5000.00	5600.00	6300.00	7100.00	8100 00	9100.00	10100.00	11000 00	11000.00
	Proposed addition	400.00	500.00	600.00	700.00	800 00	1000.00	1000.00	1000.00	1000.00	900.00	—

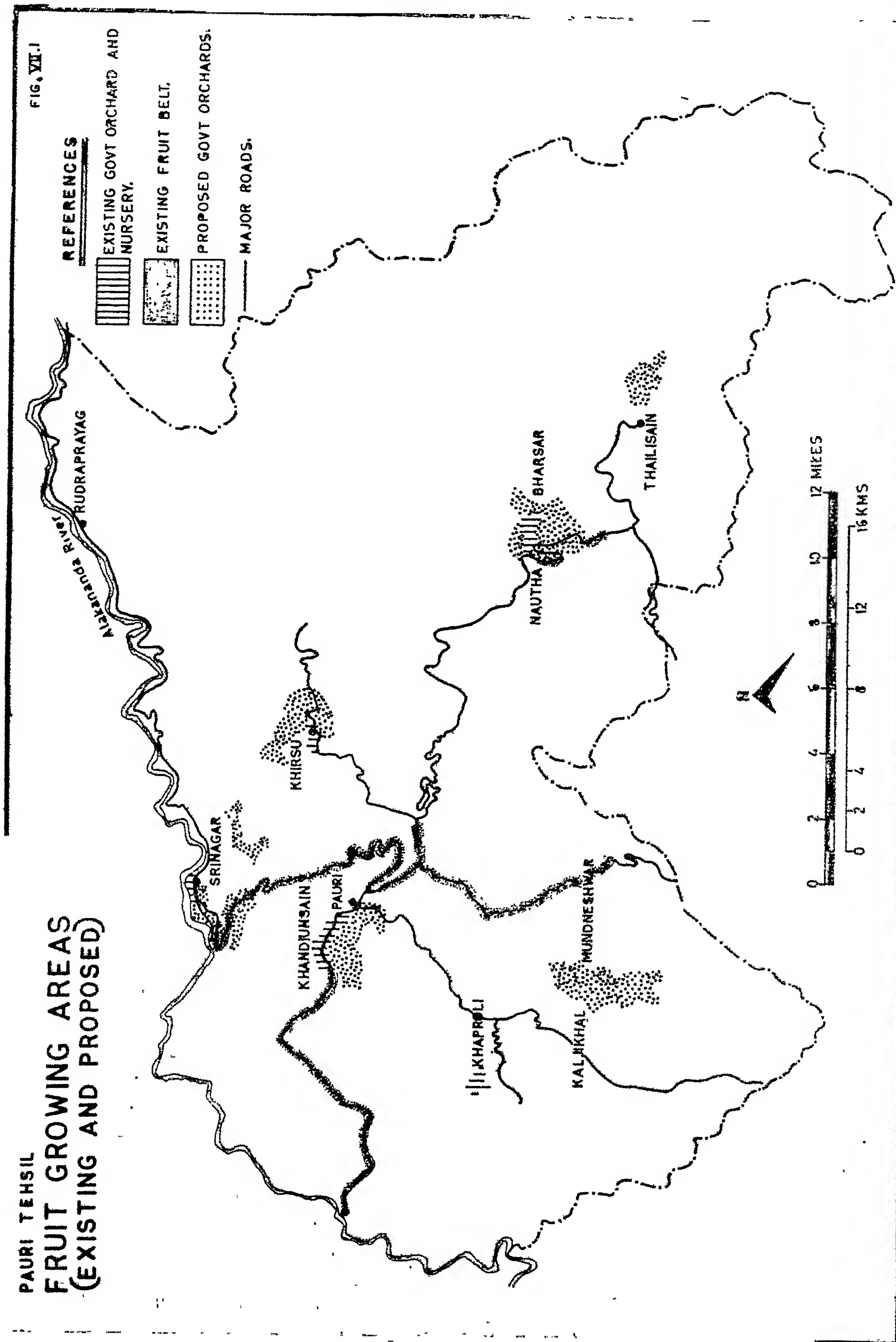
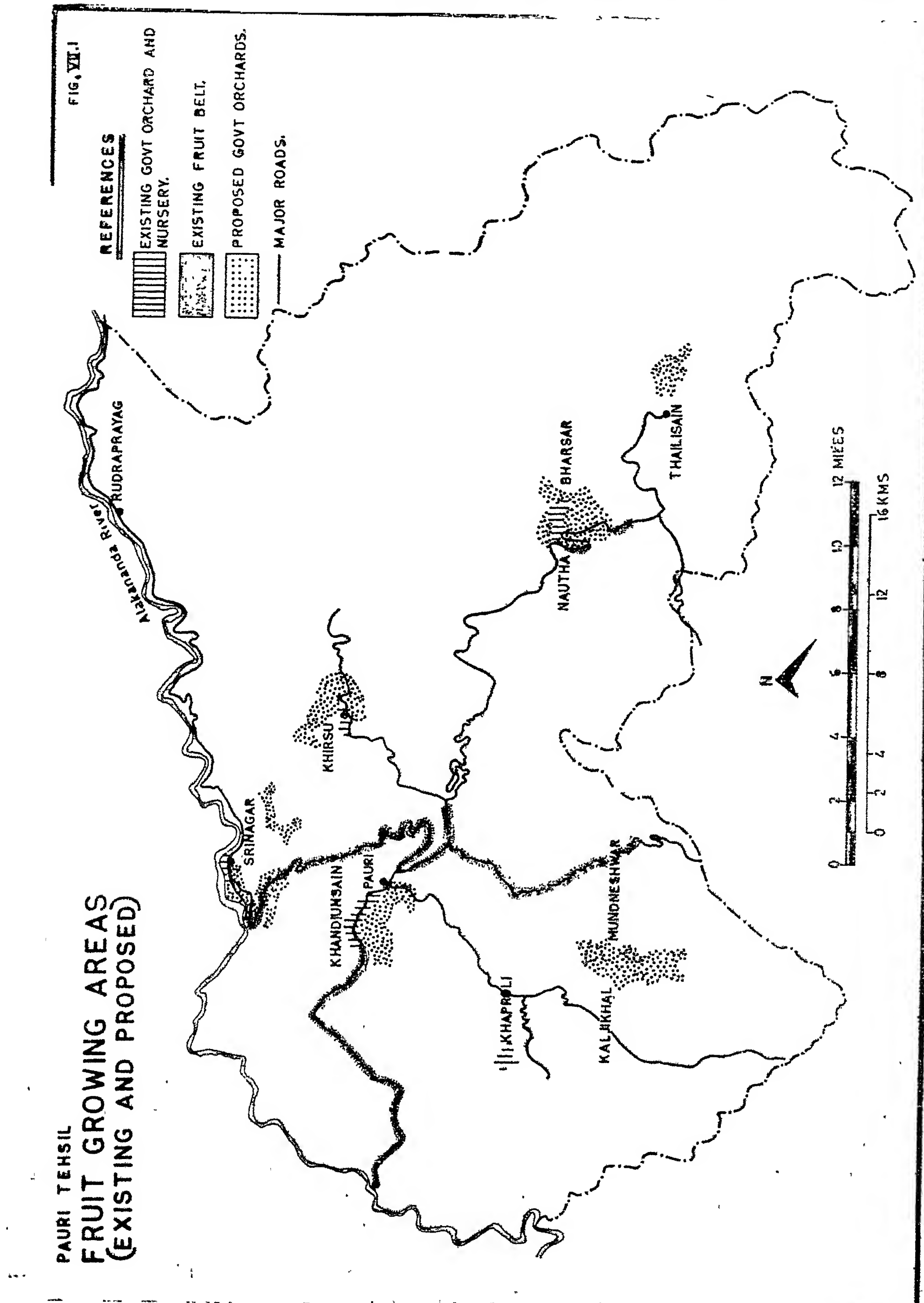


FIG. VII.1

PAURI TEHSIL
FRUIT GROWING AREAS
(EXISTING AND PROPOSED)

TABLE VII.5 : EXISTING AND PROPOSED AREA IN HECTARES UNDER HORTICULTURE 1974–1984

S.No.	Name of fruit	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1.	Apple	1575.00	1775.00	2025 00	2325 00	2675.00	3075.00	3575.00	4075.00	4575.00	4744 00	4744.00
2.	Peaches	250.00	270.00	295.00	325 00	360.00	399.00	449.00	498.00	548 00	597 00	597.00
3.	Pear	120.00	238.00	260.00	286 00	317.00	352 00	391.00	439.00	483.00	527 00	527.00
4.	Plum	180.00	194.00	212.00	233.00	255 00	283 00	319 00	354 00	390.00	425 00	425.00
5.	Apricot	185.00	201.00	219.00	241.00	268 00	298.00	335.00	372.00	409 00	800 00	800 00
6.	Walnut	248.00	267 00	292.00	322.00	357.00	396 00	445.00	495.00	544 00	594 00	594 00
7.	Mango	517.00	558.00	609.00	671 00	744.00	827 00	929.00	1033 00	1136 00	1182.00	1182.00
8.	Guava	289.00	311.00	340.00	373 00	413.00	459 00	516.00	573.00	629 00	685 00	685 00
9.	Lemon	555.00	599.00	654.00	720 00	796.00	884 00	994 00	1103.00	1213 00	1258 00	1258.00
10.	Litchi	81.00	87 00	94.00	104.00	115.00	127.00	142.00	158 00	173 00	188.00	188 00
	Total	4101 00	4500.00	5000.00	5600 00	6300 00	7100 00	8100.00	9100.00	10100.00	11000.00	11000 00
	Proposed addition	400.00	500 00	600.00	700.00	800 00	1000 00	1000 00	1000 00	1000 00	900.00	—


PAURI TEHSIL
FRUIT GROWING AREAS
(EXISTING AND PROPOSED)
FIG. VII.1
REFERENCES
EXISTING GOVT ORCHARD AND NURSERY.
EXISTING FRUIT BELT.
PROPOSED GOVT ORCHARDS.
MAJOR ROADS.
Alaknanda River
RUDRAPRAYAG
SRINAGAR
KHIRSU
NAUTHA
BHARSAR
THAILISAIN
PAURI
MUNDNESHWAR
KALJIKHAL
KHAPROLI
N
12 MILES
16 KMS

it can be assumed that at least 50 per cent of the total production will be available for the fruit industries,* proposed in the tehsil.

TABLE VII.6 : FRUIT PRODUCTION 1979 AND 1984—PAURI TEHSIL

S.No.	Name of fruit	Production in tonnes	
		1979	1984
1.	Apple	5,843	9,014
2.	Peaches	758	1,134
3.	Pear	739	1.107
4.	Plum	637	956
5.	Apricot	560	1,504
6.	Walnut	891	1,337
7.	Mango	2,150	3,073
8.	Guava	1,423	2,124
9.	Lemon	2,652	3.774
10.	Litchi	159	235
	Total	15,812	24,258

Infrastructure for Horticulture Development

As in the case of agriculture, a number of infrastructural facilities are necessary for the development of horticulture. The most important among them are credit, marketing, storage and plant protection. The success of horicultural development in the tehsil depends largely on how best these facilities are provided to the farmer. It is the conjunction of all these infrastructural facilities in one place and not their total availability at different places that will contribute to the horticultural development. In the following paragraphs we have examined the extent to which these facilities will be required for the plan period. Recommendations have also been made for the location of these facilities.

Credit Facilities

Unlike agriculture, horticulture does not bring immediate returns. The orchard trees start gearing fruits after a minimum period of 5 years. In addition to the initial expenditure on plantation, a good amount has to be spent during this period on fertilizers, plant protection, etc. This economic factor is the main hindrance which often discourages the farmer to shift his main occupation from agriculture to horticulture.

We have recommended that over a period of 10 years an additional area of 8,000 hectares should be brought under horticultural crops. About 50 per cent of this area should be cultivated by the farmers and the remaining by government agencies. Based on our primary survey, it is estimated that a minimum of Rs. 5 is needed for planting one tree and 150-200 trees can be planted on one hectare of land. At this rate, the initial expenditure will be from Rs. 750-1,000. An equal amount will be required for providing fertilizers, pesticides and other plant protection operations up to the time of yielding. Investment on mechanization will also be necessary for intensive cropping.

The existing credit facilities extended by various institutions fall far short of the actual requirement. Government agencies and cooperatives should provide medium term loans up to Rs. 2,000 per hectare to the farmers. This loan should be routed through the

* For location and capacity of fruits processing and preservation industries in Pauri tehsil, see chapter on "Planning for Industrial Development" of this report.

primary multi-purpose cooperative societies or cooperative credit societies already proposed in each central village (Table VI.7) .Aside from providing loan on easy terms, incentives should also be given in the form of grants up to 25 per cent of the loan to those farmers who will be receptive to improved horticultural practices. The credit disbursing agencies such as commercial banks or cooperatives should not limit the scope of their functioning to mere disbursement of credit. As far as possible, they should devise ways and means of ensuring best utilization of credit so that the purpose for which credit is given is achieved. One of the obstacles in the effective utilization of credit is the untimely supply of inputs. To overcome this difficulty, the financial agencies may advance loans to input supply agencies so that these agencies receive their consignments in time and are able to make necessary arrangements for the distribution of inputs.

Marketing

Success in orcharding does not stop with quality produce, but extends to the distribution of the produce to the consumer. Picking of fruit, its packing, storing, transporting, procuring and delivery to the consumer in the form and at the time he desires are all of utmost importance. At present, marketing of fruits in the tehsil is done through middlemen who earn substantial profit out of this dealing with the farmers. The farmers, on the other hand, are compelled to make distress sales even before the harvesting season. There should be organised marketing at the primary level for overcoming this difficulty. The cooperative should link credit with marketing. Credit facilities must be made available immediately after the deposit of the produce in the godowns of the primary cooperatives. The linking of credit with marketing will reduce the burden of the fruit grower in meeting the expenses of transportation, handling and distribution. It is suggested that fruits collected in the godowns of primary cooperative societies should be transported to cold storages proposed in the regulated markets.

Cold Storage

Fruit culture will be more remunerative if fruits can be collected during seasons of plenty and sold in off-seasons. A large majority of fruits after their removal from the trees perish under ordinary atmospheric temperature. Cold storage plants can help in extending the period of their availability. This will considerably reduce the fluctuations in prices usually harmful to the growers.

From our analysis it has been found that the total production of fruits will be 15,812 tonnes and 24,258 tonnes in 1979 and 1984, respectively. The fruit preservation industries, taking advantage of the low prices at the time of harvest, may store a part of this harvest in their cold storage for a few months to meet their raw-material requirement. Making allowance also for the domestic consumption and export at the time of harvest, farmers need cold storage facilities for the remaining quantities which they could sell in off-seasons. Three cold storages of 900 tonnes capacity each are recommended in the cooperative sector, to be installed at Pauri, Satpuli and Thailisain by 1979. It will be necessary to double the capacity of these cold storages by 1984.

Plant Protection

Plant diseases are transmitted by micro-organisms like fungi, bacteria, viruses, etc. or due to a deficiency in plant nutrients, soil acidity or alkalinity. The most destructive

insects are root borers, tent caterpillars and stemborers. Eventhough a number of pesticides and fungicides are available for the use of farmers, a large number of fruit trees are damaged every year by these pests. The success of plant protection lies in preventing infection, as it is very difficult to kill the fungi or bacteria or to inactivate virus inside the host plant. Diseases should be detected in time and the farmers should be given advice regarding the preventive measures to be taken by them.

At present, there are six plant protection units in the tehsil which are located at Pauri, Srinagar, Khandiunsain, Kanskhet, Thailisain and Pabau. In the light of recommendations made earlier, we propose that at least one plant protection unit be located in each service centre to provide plant protection to orchards located in the hinterlands of these service centres.

Summary and Conclusion

There is excellent scope for the development of horticulture in the tehsil. Climate, altitude and soil of the area are ideal for the cultivation of temperate, tropical and sub-tropical fruits. An intensive horticulture can relieve the pressure on agricultural land to some extent and can bring a better per hectare return than agriculture. In spite of all these favourable factors, only scant attention has been given to this sector so far. The area under orchards is very small and is neglected. Some of the orchards are not accessible by all-weather motorable roads and there is no provision to preserve fruits.

The present study reveals that 8,000 hectares of land can be brought under horticulture additionally by 1984. The new orchards will occupy those areas which are not suitable for agriculture but are fit for horticulture and have also not been occupied by forest. These areas will be developed by government agencies in Kanskhet, Khandiunsain, Kyark Kaljikhal, Patisain, Mundneshwar, Srinagar, Sumari, Khirsu. Thailisain and Nautha clusters. Besides these orchards, there will be a number of small patches of fruit gardens owned by private individuals scattered all over the tehsil. Construction of roads and soil conservation measures should also be taken up simultaneously. The production of fruits in 1979 and 1984 on completion of the proposed schemes will be 15,812 and 24,258 tonnes, respectively. Based on this production, a number of fruit-based industries and fruit preservation units have been proposed for the tehsil in the chapter on 'Industrial Development'.

FORESTRY

The national forest policy lays down that India as a whole should aim at maintaining one-third of its land under forests.* It has been recommended that 60 per cent of the hill areas and 20 per cent of the plains should be developed and managed as forests. The forests of Pauri tehsil account for 56.2 per cent of the total geographical area and almost attain the standard set for hilly regions. Forests especially in hill areas, perform two important functions namely, production and protection. As a productive natural resource, forests supply a variety of commercially important goods such as timber, firewood and industrial raw materials. The protection offered by forests consists of the preservation of physical properties of the land, protection from droughts, floods and soil erosion. In making recommendations for the development of forests in Pauri tehsil we have emphasised these two aspects of forestry.

* Government of India, Planning Commission, *Fourth Five-year Plan Proposals*, (Revised) Forestry Sector, Government of India Publication, New Delhi, 1968.

Types and Distribution of Forests in Pauri Tehsil

Forests in the study area can be broadly classified into (*i*) coniferous and (*ii*) non-coniferous types.** Examples of coniferous trees observed in the area, are *Chir* (Pine), *Deodar*, Fir and Spruce. The main non-coniferous trees in the area, are *Banj* (Oak), *Sal* and *Khursu*. A major portion of the forest area is occupied by Oaks and Pines. Elevations at which the various trees are observed, are : Oak : 1,500-2,100 metres; Pine : 450-2,300 metres, and Deodar : 2,000-2,600 metres.

Some relationship between soil and forest vegetation has been established for certain species of timber.* Pine trees in the tehsil, for example, are grown in sandy loam deficient in humus and nutrients. As it is a drought resistant type of tree, it can be grown on steep slopes also. Oak, on the other hand, is distributed on the upper slopes of ridges. Clayey soil containing colloidal matter is quite suitable for the growth of Oak trees.

Classification of Forest areas. Forests have been classified in a number of ways based on their legal status, functions, exploitability and composition.† From the point of view of planning, classifications based on legal status and functions of forests are most relevant. According to legal status, forests in Pauri teshil can be divided into three broad categories (1) reserved forests, (2) community forests and (3) private forests.

Reserved Forests Reserved forests are entirely in the hands of the government and the forest departments are responsible for the maintenance, conservation and economic utilization of reserved forests.

Community Forests. These forests are owned by groups of villages and are utilized for firewood and cattle grazing. These forests are often managed by village panchayats.

Private Forests. These forests are owned by individuals and the rights of ownership, preservation and utilization are zealously guarded.

Areas under each of these categories of forests in Pauri tehsil are estimated in the Table VII. 7. @

TABLE VII.7 : AREAS AND TYPE OF FORESTS IN PAURI TEHSIL—1971

S.No.	Type of forest	Area in hectares	Percentage
1.	Reserved forests	1,16,500	92.3
2.	Community forests	7,010	5.55
3.	Private forests	2,590	2.15
	Total	1,26,100	

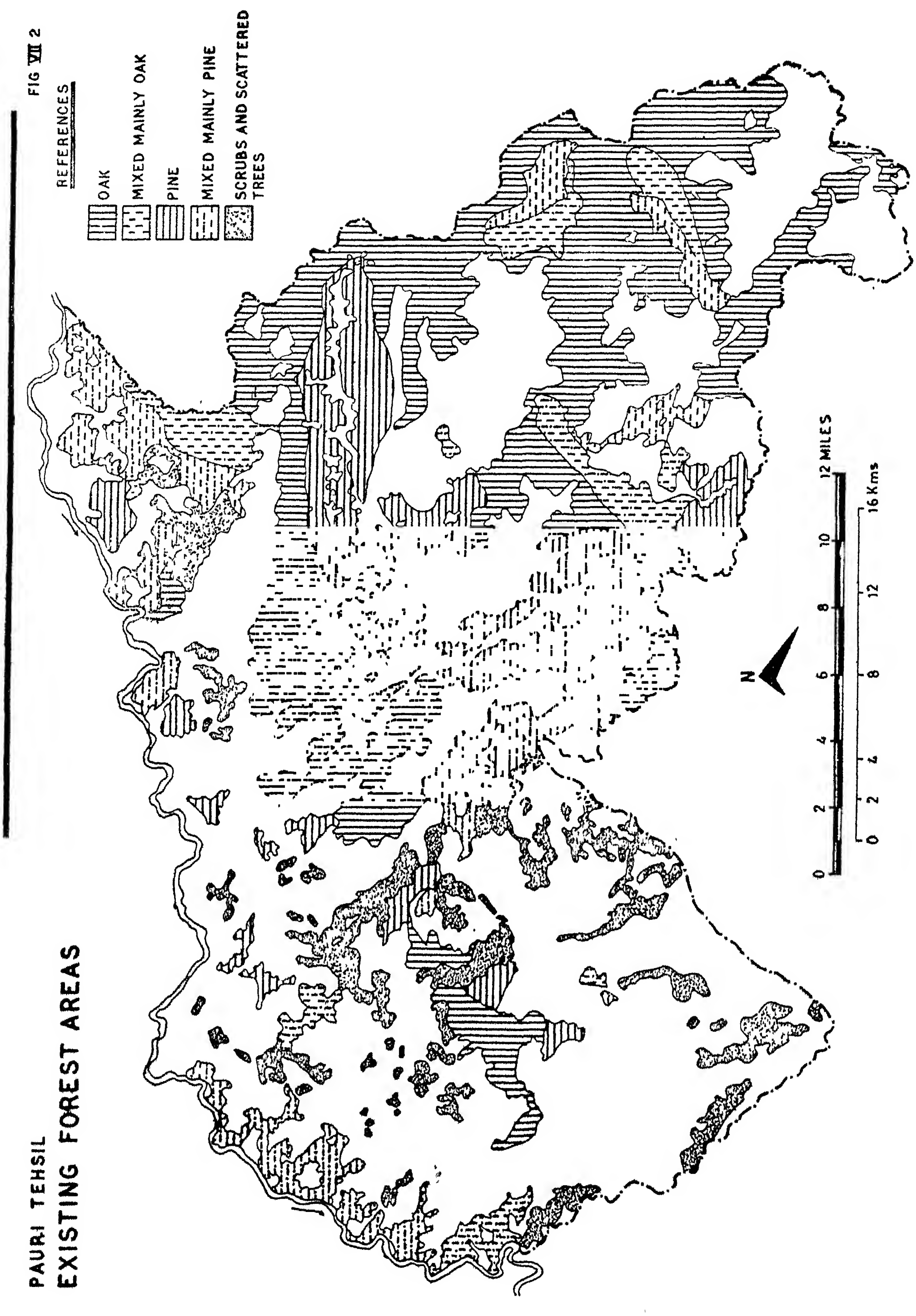
The reserved forests are generally confined to the hilly areas and to poor soils. These forests are characterised by a thick growth of vegetation and are located away from the main transportation arteries. The community forests, on the other hand, are sparsely grown

** Champion, H.H., *Indian Forest Records*, Vol. I 1936, quoted in *Indian Forest Centenary Celebration Publication*, Forest Research Institute, Dehra Dun, 1961.

* Wilde, S.A., *Forest Soils : Their Properties and Relations to Sylviculture*, Ronald Book Co., New York, 1958.

† *Op cit*, Vol. II.

@ The forest area under each type is estimated from the forest maps made available by the Divisional Forest Officers at Pauri and Lansdowne.


PAURI TEHSIL
EXISTING FOREST AREAS
FIG VII 2
REFERENCES
OAK
MIXED MAINLY OAK
PINE
MIXED MAINLY PINE
SCRUBS AND SCATTERED TREES
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 Kms

and are mainly used for firewood and cattle grazing. In the tehsil, community forest private forests constitute only 7.7 per cent of the total forest area.

Forests can also be classified by their productive and protective functions alt there is bound to be some overlap. It has been estimated that productive forests con 76,500 hectares (61 per cent) of the total forest area in the tehsil while the remaining hectares (39 per cent) is under protective forests.

Forest resources. Reserved forest areas are the main source of timber tehsil. In 1971, out of 1,16,100 hectares of reserved forests, 69,011 hectares was unc jurisdiction of Pauri Forest Division while the remaining area was under Lansdowr Gopeshwar Divisions. Statistics on production could be collected only for the a 69,011 hectares falling within the Pauri Forest Division. Table VII.8 shows the under different species of timber and their production in the Pauri Forest Division.

TABLE VII.8 : AREA AND PRODUCTION OF TIMBER IN 1971 (PAURI FOREST DIVISION)

S. No.	Species of timber	Area in hectares	Percentage	Production in cu. m.	Perc
1.	Chir (Pine)	25,440.7	36.90	3,985.00	49
2.	Bang (Oak)	32,408.2	46.92	1,630.00	20.
3.	Kharsu	2,173.2	3.05		
4.	Sal	390.7	0.56		
5.	Deodar	8.8	0.02		
6.	Fir and Spruce	4,057.6	5.80		
7.	Cypress	23.4	0.04	For species 3—8 together	
8.	Miscellaneous	4,508.8	6.53	2,414.26	30
	Total	69,011.4		8,029.26	

Source : Divisional Forest Office, Pauri.

Table VII.8 shows that in 1971 87.82 per cent of the total forest area in the Forest Division was covered by Pine and Oak. While Oaks have the largest area (13 p more than Pine), Pines yield the highest production (more than twice the product Oaks). In terms of production, the performance of other species such as Fir, Spruc Deodar, and Kharsu is much better than Oaks. Out of the 8,029.26 cu.m. of timber pr during the year 1971-72, 6,399.26 cu.m. (79.8 per cent) was commercial wood and the r ing inferior firewood. The total value of these products was Rs. 7.54 lakhs. Th per hectare works out to 9.25 cu.m. of timber per hectare. During the same perio corresponding figure for U.P. was 0.09.*

Utilization of forest resources. The demand for forest products such as industrial raw materials and domestic fuel has been increasing during the past few There is an acute shortage of raw materials for forest-based industries in the country s

* National Council of Applied Economic Research, *Techno-Economic Survey of Uttar Pradesh,* Publication, New Delhi, 1965.

pulp, paper and newsprint. The tragedy is that although this shortage can be easily met by our forests in Pauri and other hill areas which contain a variety of timbers of high commercial value, they cannot be used because of lack of transportation facilities or due to the lack of a streamlined organization for economic cutting of trees and transporting them to the consumer. In addition, a large volume of good timber is wasted because of poor handling and management during cutting and logging.

Much of the timber produced in the tehsil is cut into pieces at the resource area itself. Pines which have the highest per hectare yield in the tehsil fall in this category. Pine wood is mainly used for railway sleepers and as raw material for the Pulp and Paper Mill at Saharanpur. (The Paper Mill at Saharanpur has an installed capacity of 4,000 tonnes of writing paper). Resin, an important product of Pine trees yields a large number of useful products including turpentine. The out turn from resin in the tehsil during 1971-72 was Rs. 11.7 lakhs.

Oaks, on the other hand, do not have such a wide range of commercial use. In some parts of the tehsil, particularly in Khirsu block silk worm is fed on Oak leaves. Timber from Oak trees is often used for fire wood and charcoal.

Medicine herbs, another forest product, with a great deal of potentiality also grow in these forests. These herbs are extensively used in the villages and bring people who collect, process and sell them.

Potentialities and Problems of Forest Development

Potentialities. The prospects of forestry in the tehsil mainly depends on the future demand of forest products. The demand for forest products is not limited to the tehsil only. There is a growing demand for pulp for manufacturing paper, board, newsprints, etc. in the country as a whole. The current acute scarcity of newsprint is not just a temporary phenomenon. By all counts, the demand for pulp is going to grow in the country as well as abroad. At present, the raw material for the paper plant at Saharanpur is being met by the forests in Pauri Garhwal. With the increase in demand for writing paper, there is scope for additional paper mills and the study area with its Pine forests could be an ideal location for such an industry.*

The demand for railway sleepers made of pine wood is also expected to increase. There will also be an increasing demand for resin used as raw material in a number of chemical industries. On the whole, coniferous trees such as Pine have excellent industrial and commercial prospects. It follows that in all future afforestation programmes, emphasis should be given on the large-scale plantation of coniferous trees especially Pine.

Problems of development. In the Garhwal hill regions the local residents were allowed free and unrestricted grazing of their cattle in the forest areas. Except for a few species such as Deodar and Cypress, they were also permitted to fell and lop trees for their own use. Overgrazing and haphazard control over cutting, have caused serious setback to the tree crops. The present practice of leaving the harvest to contractors without proper supervision and control has also caused a lot of damage to the forests. The merciless cutting of the trees by both authorized and unauthorized persons has caused disastrous soil erosions and the denudation of a valuable natural resource.

Forest development policy. The following policies have been formulated for a rational development and management of the forest areas in the tehsil.

* For a discussion of this proposal, see chapter on "Planning for Industrial Development" of this report.

(1) The forests which are at present degraded and not productive must be cleared and quick growing species with commercial and industrial value (particularly for pulp and paper and chemical industries) be replanted in this area.

(2) Barren land lying between agricultural areas and reserve forests which are neither suitable for agriculture nor for horticulture due to difficult slopes and unfavourable soil conditions must be brought under plantation. Initially, such land will not be able to support a tree crop of full growth or full density of stocking. The initial purpose of such planting will, therefore, be soil reclamation and soil conservation until the quality of land improves for commercial forestry.

(3) Rules against unregulated lopping, unlimited grazing and unauthorized use of forest products must be strictly enforced.

(4) An intensive road construction programme must be taken up for connecting inaccessible forest areas with arterial routes and an average of at least one km. length of road for every square kilometre of forests should be attained as rapidly as possible.

(5) Community forests should be developed close to the villages to provide them with fire wood and grazing land. Land which is unsuitable for agriculture and horticulture and is in proximity to the villages should be used for such forests. Community forests which are not managed properly must be brought under the management of the forest department and given back to the villages when fully restored.

Recommended forest development programme. Based on the policies stated above, a ten-year forest development programme is suggested below :

1. About 49,500 hectares (39 per cent) of the total forest area has been found to be covered by degraded and understocked stands. This area is mainly covered by Oak trees and a major portion of this area falls in the clusters Tarpali, Gadoli, Gidokhal, Molkakhal, Barsuri, Nautha, Chaunrikal and Thailisain. A phased programme of rehabilitation of this area by planting trees with industrial importance such as Deodar, Fir, Spruce and Pine are proposed. Another area of 16,500 hectares falling in the clusters Tarpali, Gadoli and Gidokhal and lying at an altitude of above 2,000 metres is also proposed for plantations of Deodar, Fir and Spruce. The remaining area (33,000 hectares) must be brought under Pine cultivation. Of these 33,000 hectares, the area falling in the clusters Molkakhal and Barswi (15,000 hectares) and with better accessibility should be brought under plantation in the first five years. The remaining area (about 18,000 hectares) lying in the Nautha, Chaunrikal and Thailisain clusters with poor accessibility should be included in the second phase (1979-84) of development. In all of these areas clear cutting of trees and improvement of communication facilities must be taken up simultaneously so that seedlings and other planting equipments can be brought to the site without difficulty.

2. An area of 11,175 hectares is being proposed for community forests in addition to the existing area of 7,010 hectares. The proposed area under community forests in each cluster has been shown in Table VII.9.

3. The Oak forest in Khirsu cluster with an area of 5,000 hectares has been earmarked for the rearing of silk worms. This forest area has to be regenerated by re-plantation.

4. A detailed road development programme has been worked out and shown in the chapter on transportation. In proposing roads, special attention has been given to the hill coniferous areas which are largely inaccessible at present.

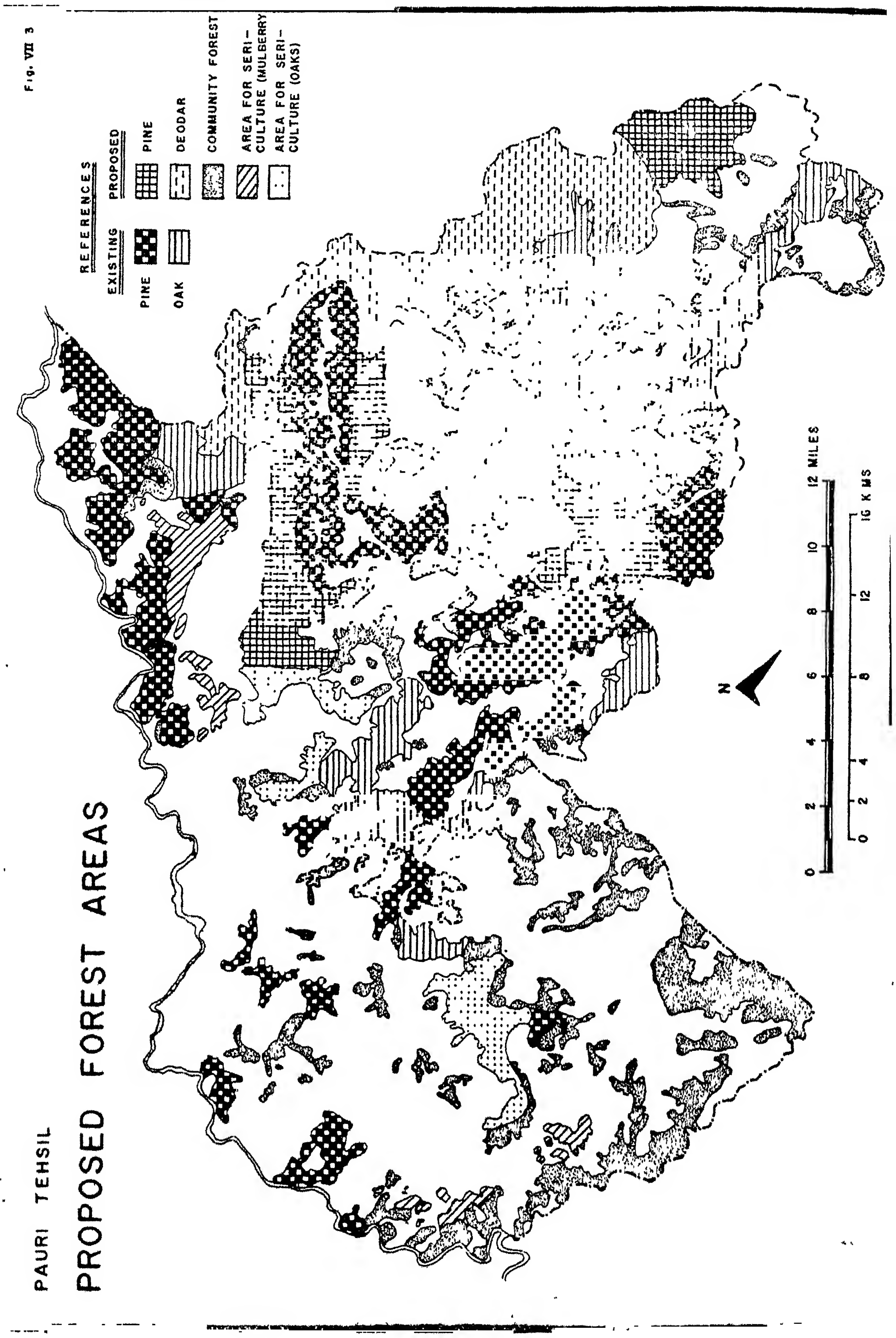

PAURI TEHSIL
PROPOSED FOREST AREAS
REFERENCES
EXISTING
PROPOSED
PINE
OAK
PINE
DEODAR
COMMUNITY FOREST
AREA FOR SERI-CULTURE (MULBERRY)
AREA FOR SERI-CULTURE (OAKS)
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

Fig. VII 3

TABLE VII 9 PROPOSED AREA UNDER COMMUNITY FORESTS IN PAURI TEHSIL—1984

S.No.	Name of cluster	Area in hectares	S.No.	Name of cluster	Area in hectares
1.	Bahbazar	295 00	38.	Chaubatiakhal	127.50
2.	Ghindwara	1,067.50	39.	Choprium	37.50
3.	Baganikhal	697.00	40.	Bhainswara	7.50
4	Diusi	765.00	41.	Sikukhal	385.50
5	Ghandiyal	525.00	42.	Pokhrikhet	455.00
6	Kanskhet	355.00	43.	Champeshwar	127.50
7.	Nahsain	225.00	44.	Pabau	107 50
8	Safdarkhal	20 00	45.	Khrisu	157.50
9	Kamalpur	Nil	46	Bhattisera	197 50
10.	Jamalakhal	306.00	47.	Kherakhal	392.50
11.	Saknikhet	42 50	48.	Mailisain	172.50
12.	Khandiunsain	80.00	49.	Chifalghat	627.50
13.	Kot	125.00	50.	Sankarsain	152.50
14.	Kholachaunri	75.00	51.	Cholusain	122.50
15.	Lwali	137.50	52.	Bajwar	80.00
16.	Adhwani	87.50	53.	Damdeval	Nil
17.	Kaljikhal	155.00	54.	Chaunrikhal	30.00
18.	Denchaunri	Nil	55.	Pokhri	50.00
19.	Banghat	512.50	56.	Bhira	362.50
20.	Satpuli	775.00	57.	Thailisain	305.00
21.	Kandarpani	850.00	58.	Nautha	270.00
22.	Mawadhar	412 50	59.	Chakisain	312.50
23.	Patisain	187.50	60.	Paithani	57.50
24.	Mundneshwar	Nil	61.	Barsuri	212.50
25.	Pipalipani	537.50	62.	Rudraprayag	722.50
26.	Jakheti	250.00	63.	Khankara	107.00
27.	Agrora	250.00	64.	Sumerpur	Nil
28.	Paidul	117.50	65.	Ratura	Nil
29.	Parsundakhal	282.50	66.	Molkakhal	170.00
30.	Kandara	250.00	67.	Gidokhal	Nil
31.	Bubakhal	300.00	68.	Chaunra	225.00
32.	Daduadevi	62.50	69.	Gadoli	460.00
33.	Pauri	752.50	70.	Tarpali	440.00
34.	Kyark	25.00	71.	Bungidhar	390.00
35.	Kirtinagar	Nil	72.	Samoya	350.00
36.	Srinagar	Nil			
37.	Sumari	47.50		Total	18,185.00

5. Control of unregulated lopping and grazing of land will create problems for local people who have come to depend on such practices as their regular livelihood. With the enforcement of forest rules, alternative employment for these people will have to be found. The increased need for forest labour for road construction, planting and other subsidiary occupations such as poultry farming, sheep and cattle rearing proposed elsewhere in this report, will improve their employment opportunities. However, educating these people to the necessity of good forest maintenance should go hand in hand with these developments.

Expected yields. The yield of timber up to 1984 will be only from the existing forest areas. Even the fastest growing timber will be eligible for cutting only after ten years. The

newly proposed Pine plantation areas can, therefore, be expected to yield only after 1984. No reliable data are available on the overall volume of timber that will be available in the future. A study of the forest areas of U.P. by N.C.A.E.R.* shows that by improving accessibility, effective forest management and modern logging practices, the annual production can at least be doubled. This figure, we feel, is quite modest as the construction of roads proposed in this report will open up a very large forest area to commercial traffic. If we use the N.C.A.E.R. norm, then the estimated yield of timber in the tehsil during 1979 and 1984 will be about 21,000 cu.m. and 28,000 cu.m., respectively. About 50 per cent of this timber will be Pine. The yield of resin in the study area during 1979 and 1984 will be 21,500 and 29,000 quintals, respectively.

SERICULTURE

Sericulture encompasses a large number of activities starting from the cultivation of Mulberry/Oak to the weaving of silk. In each stage it provides considerable employment opportunities to skilled as well as unskilled workers. Silk fibre which is the ultimate product in this process can be put to a variety of uses. Besides, the production of raw silk is export oriented,and of late, is in short supply in the country. Considering the employment potentiality and a fairly good market, this sector has bright future and needs expansion.

Pauri Garhwal is one of the few districts in Uttar Pradesh where sericulture has been started in an organised way. The factors which account for it are favourable climate and soil. This makes it possible to produce both mulberry silk and tassar silk in the tehsil. Mulberry silk worms feed on mulberry leaves while tassar silk worms prefer Oak leaves. In spite of the above favourable conditions, silk worm rearing and allied activities are confined to a very small area in the tehsil. Silk worms are currently reared on an experimental scale in Bilkhet in Kaljkhal Block and in Khirsu. At present, sericultural activity is limited to the stage of producing cocoons and the subsequent operations are being done outside the tehsil. The different stages of the sericulture operation are as follows :

1. Cultivation of Mulberry/Oak trees
2. Rearing silk worms
3. Reeling silk
4. Silk weaving

The quality and quantity of Mulberry/Oak leaves is an important factor in the economy of silk production. The cost of these accounts for about 3/5 th of the cost of the cocoons as one tonne of leaves are required to rear one ounce of silkworm seeds for about 42 days before they mature.† Mulberry is a sub-tropical plant which can be grown in a large variety of soils although it does better in clay loam than in sandy soils.

Rearing silk worms consists of different stages. First worms hatched out of eggs are fed on Mulberry or Oak leaves for six weeks and it grows to some 10,000 times during this period. Once the feeding is over, worms are shifted to a bamboo or straw cocoonage where they spin the cocoons within a couple of days. After 10 or 12 days the caterpillars are

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* National Council of Applied Economic Research, *Techno-Economic Survey of Uttar Pradesh*, N.C.A.E.R. Publication, New Delhi, 1965.

† National Council of Applied Economic Research, *Techno-Economic Survey of Mysore*, chapter on "Sericulture", N.C.A.E.R. Publication, New Delhi, 1965, pp. 38-52.

transformed into moths and pierce the cocoons. The cocoons are stifled before they are pierced and taken for reeling.

The unwinding of silk thread from cocoons is known as reeling and it is either done mechanically or on traditional hand-operated charkas. Each cocoon has an average silk thread of about 325 yards to 500 yards. The yarn thus reeled is used for weaving.

Development programmes in sericulture. To increase the quantity and quality of raw silk the following programmes should be implemented.

Expansion of area under Mulberry trees. In addition to the existing area under Mulberry trees another 1,000 hectares are proposed for Mulberry cultivation. The selected locations are the valley areas along Alakananda and Nayar rivers (See Fig. VII. 3). The present yield of Mulberry leaves is estimated at about 4,000 to 6,000 Kgs.* per hectare. This yield can be considerably increased by using improved grafts, fertilizers and irrigation facilities. For providing improved variety of grafts, four nurseries should be started in the tehsil. A conservative estimate of the production of Mulberry leaves from the proposed area of 1,000 hectares will be about 5,000 tonnes. According to the norms suggested by the Central Silk Board, it will be sufficient to produce 245 tonnes of Cocoons.** Percentage of silk in the Cocoons varies from 7 to 8 per cent.*** Assuming an average recovery of 7.5 per cent, the production of silk will be 18.5 tonnes.

As regards the food plants for tassar silk worms, there is already a vast area under Oak trees in the taluk and can be economically exploited. At present, tassar silk worms are being reared on an experimental scale in Khirsu and Adhwani. In addition it is proposed to plant Oak trees in the community forest areas also (see Fig. VII. 3). It is estimated that tassar silk will constitute about 50 per cent of the total production of silk in the Tehsil.

Silk-worm seed supply. For increasing the productivity of cocoons, the cooperatives should take the responsibility of supplying certified seeds to the farmers. As mortality is very high in the initial stages of rearing, there should be proper supervision and management by the departmental agencies.

Cocoon marketing. A good marketing organization is a pre-requisite for a proper development of sericulture. Unless reasonable and suitable prices are assured to the rearers, there is no hope for improving the quality. If the collection and distribution of cocoons are also done by the cooperatives which would already be responsible for seeds, the problem can be substantially reduced.

Raw silk reeling. The reeling of raw silk is usually done with charkas or by filature units. Although reeling by charkas is less expensive, the quality of silk fibre produced is generally poor. On the other hand, the cost of filature units which produce quality fibres, is high and the marginal farmers may not be able to afford these on their own. A combination of charka and filature operations may be a good solution. Assuming a rated capacity of spinning of 250 Kgs. per annum, it is estimated that about 200 charkas will be needed in the tehsil. A filature unit can process 80 to 100 kgms fibres per spindle. Thus two spindles are required to replace one charka.

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* N.C.A.E.R , *Ibid,* p. 40

** As per the evaluation of the Central Silk Board, one hectare of Mulberry trees can support about 245 Kgms of cocoons. See National Commission on Agriculture, Government of India, *Interim Report on Sericulture,* New Delhi, 1973, p. 7.

*** N.C.A.E.R., *Op cit,* p. 41.

Economics of sericulture. The net profit from sericulture on one hectare of land under rain-fed and irrigated conditions are worked out at Rs. 1,132-50 and Rs. 4,707-50, respectively. The details are as follows :

TABLE VII.10. ECONOMICS OF SERICULTURE

Item	Rain-fed conditions (in Rs.)	Irrigated conditions (in Rs.)
I. *Cost of cultivation*		
1. Manure	100	200
2. Fertilizer	—	405
3. Agricultural operations	505	2,022 50
	605	2,627.50
II. *Cost of Rearing*		
1. No. of disease free layings (DFLS) (eggs)	1,125	3,325
2. Cost Rs. 10/- per 100 (DFLS)	112 50	332 50
3. Labour charges	100 00	332.50
	222.50	665.00
III. Total paid out cost (I + II)	827.50	3,292.50
IV. *Sale of cocoons*		
a. Output (Kg.)	245	800
b. Value**	1,960	8,000
V. *Return*		
IV (b) minus III	1,132.50*	4,707.50

* Including irrigation charges.

** At the rate of Rs. 8/- per Kg. under rain-fed conditions
At the rate of Rs. 10/- per Kg. under irrigated conditions.

Source : The Central Silk Board quoted in National Commission on Agriculture, Government of India. *Interim Report on Sericulture*, New Delhi, 1973, p. 7.

CHAPTER VIII

PLANNING FOR THE DEVELOPMENT OF ANIMAL HUSBANDRY

In the study area, more than 90 per cent of the cultivators come under the category of small and marginal farmers with a per capita net sown area of only .21 hectares. Our recommendations for the improvement of agriculture in the tehsil will, if implemented, increase production but deficits will remain in the major food staples until 1979. Only by 1984, farmers will be able to get a marginal surplus from their lands. The major benefit of this increased production will naturally go to those who will hold slightly larger pieces of land with irrigation facilities. For the majority of the farmers, there will be very little surplus which can be converted into cash for buying necessities of life other than food. Horticulture is, of course, a paying proposition but as we have seen, it takes a minimum of five years before fruit trees become commercially productive. There will be increased employment opportunities as a result of a higher tempo of industrial activities but only a certain percentage of people will be able to find jobs. There will, therefore, be a large number of farmers who will be in need of cash to buy daily necessities of life and to comple ment the food supply from their own lands.

The purpose of this chapter is to explore the scope of animal husbandry as an occupation which will provide an alternative source of employment and income in the tehsil. We have seen that after reclaiming potential areas for agriculture, allotting lands for horticulture and afforestation, very little land will be left for expanding the existing grazing areas. There is scope for combining community forests with grazing lands, however. If this can be done along with the adoption of a few other measures discussed later in this chapter, animal husbandry can be a profitable subsidiary occupation for a majority of the farmers and possibly a primary occupation for some of the farmers.

CATTLE DEVELOPMENT

Problems and Prospects

The livestock statistics show that there is a large number of cattle and buffaloes in the tehsil although the production of milk is extremely low. For the purpose of this chapter, we are including both cows and buffaloes under the category of "cattle". The average milk production is reported to be about 110 kgms. per cow and 325 kgms. per buffalo whereas the estimated yields of a cross-bred cow and improved buffalo, on the other hand, are about 2,000 kgms. and 3,000 kgms, respectively.

The total milk production in the tehsil, in spite of the presence of a large cattle population, is also extremely low and falls far short of local requirements. The per capita availability of milk in the tehsil during 1961 was as low as 140 gms. per day. According to one estimate, the minimum requirements of milk per day for the following categories are : pre-school children—300 gms, school children —250 gms and adults—200 gms.* Judged by these standards, the per capita per day availability of milk in the tehsil was very low indeed.

* Interim *Report on Milk Production by Small and Marginal Farmers and Agricultural Labourers*, National Commission on Agriculture, Government of India, 1971.

The major problems which reflect on milk production in the tehsil are as follows :

1. *Feeding*. Poor feed is one of the major constraints in increasing milk production of cows and buffaloes. Although the tehsil is covered by large areas of reserved forests and some illegal grazing does take place, these areas are generally not available for cattle grazing. The community forests maintained by the Gramsabhas are open for grazing. The condition of these forests is so poor due to overgrazing and soil erosion that the vegetation available for grazing is far from adequate. Also very little land is available for growing fodder crops exclusively as practically all available agricultural land is pressed into the cultivation of food crops. The scope for increasing the quantity and quality of feed has been examined later in this chapter.

2. *Quality of animals*. The genetic potential for milk production among the cattle and buffaloes in the tehsil is generally very low. Improvement of the inherent producing capacity of the buffaloes and cows must come largely from breeding by artificial insemination and selection from within the existing stock. Only a few exotic bulls are, however, available with the Gramsabhas at present and the nearest artificial insemination centre is far down in the south at Kotdwara.

3. *Prevalence of disease*. Due to inbreeding and lack of good feed the cattle in the teshil are extremely vulnerable to diseases. The most common disease is anthrax which can be prevented by immunization. The facilities for large-scale immunization and curative treatment of animals are extremely inadequate in the tehsil. There are only eihgt veterinary hospitals and 20 veterinary dispensaries and stockman centres in the tehsil. This falls far short of the standard of one veterinary dispensary for every 5000 livestock as suggested by the National Commission on Agriculture. Even these eight hospitals are not well equipped and not connected with the surrounding villages by road.

4. *Milk marketing*. Though there is shortage of milk and milk products in the urban areas in the tehsil, there is no organised collection and distribution system. Villagers either sell milk locally at a distress price or exchange it for other commodities.

The problems discussed above are the results of long neglect, economic backwardness, pressure on land and inbreeding of the cattle. Any cattle development programme for this area must try to solve some of these basic problems first. Given certain minimum facilities, cattle farming can be a profitable occupation as has been shown in many studies. In an investigation carried out in Nasirpur, Patiala, for example, it was found that the net returns per hectare in the dairy, mixed and arable farming units were about Rs. 1,480, Rs. 1,348 and Rs. 1,107 per annum, respectively. The respective average net returns per Rs. 100 invested were Rs. 16.6 in the dairy farming unit, Rs. 16.4 in the mixed farming unit and Rs. 13.3 in the arable farming unit.* There is no doubt that without careful planning committed extension work and heavy investments on an adequate infrastructure, it will be impossible to introduce commercial dairying at this level of profit in the tehsil. We have already discussed the problems which inhibit the growth of a healthy cattle population in the area. These problems must be removed first before thinking of commercial dairying of any scale. Recommendations for the improvement of the present stock have been made later in this chapter. As we have already seen, there is no dearth of demand in the tehsil for

* Pant K.C. and Chaugh K.K., "Productivity of Different Systems of Farming—A Comparative Study". *Indian Farming* Vol. 20, January 1971, also I.C.A.R., *To Study the Economics of Specialized Dairy Farming Under Various Conditions* (Final Report, October, 1962—September, 1968), National Dairy Research Institute. Karnal. Haryana (Mimeo).

milk and if carefully planned development programmes are introduced in the area, the farmers will certainly be able to increase their milk production considerably. Commercial dairying could be the next step. We have examined the issue in detail later in the chapter.

A Proposed Programme for Cattle Development

On the basis of our discussion on the problems of cattle development in the study area, two major constraints can be easily identified : (1) the shortage of nutritious fodder and (2) the poor genetic quality of the cattle. Our proposed programme for cattle development revolves around the solution of these two problems. We shall deal with the problem of fodder shortage first.

Availability of Fodder

1. *Fodder from agricultural land.* Fodder can be obtained from the crop residue of cultivated cereals like paddy, maize, wheat, etc. or can be grown as an independent crop. Considering the scarcity of cultivable land and food deficit in the tehsil, it is not desirable to bring large areas under independent fodder crops. The bulk of the fodder from agricultural lands must, therefore, come from residue of cereal and leguminous crops. In the study area, the main crops namely, paddy, wheat, barley, mandua and jhangora constitute 92 per cent of the gross cultivated area. The volume of the residue of all of these cereal crops is quite large. The yield varies from 2,000 to 2,500* kgms. per hectare. Based on the proposed gross sown area for 1979 and 1984, the availability of fodder will be about 1.95 lakh tonnes and 2.5 lakh tonnes, respectively. Cluster-wise estimation of crop residue is shown in Table VIII. 1.

TABLE VIII.1 : ANNUAL PRODUCTION OF FODDER FROM COMMUNITY FORESTS AND ARABLE LAND (IN TONNES) 1979 AND 1984

S. No.	Name of the Cluster	1979			1984		
		Fodder from community forest	Fodder from Arable Land	Total	Fodder from community forest	Fodder from Arable Land	Total
1	2	3	4	5	6	7	8
1.	Bahbazar	7237	1659	8896	11062	2945	14007
2.	Ghindwara	26175	6853	33028	40031	8509	48540
3.	Baganikhal	17081	4886	21967	26137	6559	32696
4.	Diusi	18750	2737	21487	28687	3505	32192
5.	Ghandiyal	12862	3266	16128	19687	5468	25155
6.	Kanskhet	8700	2970	11670	13312	4521	17833
7.	Nahsain	5512	3665	9177	9562	5021	14583

* Hand Book of Agriculture, I.C.A.R., New Delhi, 1961.

TABLE VIII 1 : (*Contd.*)

1	2	3	4	5	6	7	8
8.	Safdarkhal	487	3315	3802	750	4239	4989
9.	Kamalpur	Nil	1551	1551	Nil	3440	3440
10.	Jamlakhal	7463	3199	10662	11437	4853	16290
11.	Delchauni	2031	3658	5689	1575	4735	6310
12.	Khandiunsain	1950	2953	4903	3000	3093	6093
13.	Kot	3075	3349	6424	4687	3292	8279
14.	Khelachaunri	1837	2218	4055	2812	3416	6228
15.	Lwali	3375	2459	5834	5156	3928	9084
16.	Adhwani	2138	1107	3245	3281	1879	5160
17.	Kaljikhal	3806	2868	6674	5812	3164	8976
18.	Sakrikhet	Nil	2069	2069	Nil	3549	3549
19.	Banghat	12563	2996	15559	19218	4907	24125
20.	Satpuli	21018	3463	24481	29062	4254	33316
21.	Kandarpani	20831	4153	24984	31875	5075	36950
22.	Mawadhar	10125	1470	11595	15468	1814	17282
23.	Patisain	4593	1139	5732	7031	1368	8399
24.	Mundneshwar	Nil	3575	3575	Nil	4182	4182
25.	Pipalipani	13181	1775	14956	20156	1314	21470
26.	Jakheti	6131	2353	8484	9375	3234	12101
27.	Agrora	6131	2930	9061	9375	3234	12609
28.	Paidul	2868	2035	4903	4406	2802	7208
29.	Parsundakhal	6937	3733	10670	10593	4320	14913
30.	Kandara	6131	1668	7799	9375	2280	11655
31.	Bubakhal	7425	1740	9165	11250	1737	12987
32.	Daduadevi	1537	1620	3157	2343	2128	4471
33.	Pauri	18450	4078	22528	28218	4304	32522

TABLE VIII 1 : (*Contd.*)

1	2	3	4	5	6	7	8
34	Kyark	618	3890	4517	937	4407	5344
35.	Kirtinagar	Nil	1405	1405	Nil	2665	2665
36.	Srinagar	Nil	2318	2318	Nil	4614	4614
37.	Sumari	1162	5791	6953	1781	6296	8077
38.	Chaubatiakhal	3131	1732	4863	4781	2079	6860
39.	Choprium	918	1697	2615	1406	1348	2754
40.	Bhainswara	187	775	962	281	779	1062
41.	Sikukhal	9450	1808	11258	14456	1965	16421
42.	Pokhrikhet	11156	4041	15197	17062	4277	21339
43.	Champeshwar	3131	2290	5421	4856	3109	7965
44.	Pabau	2643	2764	5407	4031	3200	7231
45.	Khrisu	3862	5151	9013	5906	5917	11823
46.	Bhattisera	4837	3290	8127	7406	4642	12048
47.	Kherakhal	9618	4232	13850	14718	6018	20736
48.	Mailisain	4237	2389	6526	6468	3808	10276
49.	Chifalghat	15375	1880	17255	23531	3354	26885
50.	Sankarsain	3750	1749	5499	5718	3259	8977
51.	Cholusain	3000	1595	4595	4593	1871	6446
52.	Bajwar	1968	821	2789	3000	812	3812
53.	Damdeval	Nil	1627	1627	Nil	2395	2395
54.	Chaunrikhal	750	821	1571	1125	821	1964
55.	Pokhri	1237	699	1936	1875	722	2597
56.	Bhira	8887	1580	10467	13593	1567	15160
57.	Thailisain	7481	4736	12217	11438	6033	17471
58.	Nautha	6618	2154	8722	10125	2992	13117
59.	Chakisain	7668	2385	10053	11718	3520	15248

TABLE VIII 1 : (*Contd.*)

1	2	3	4	5	6	7	8
60.	Paithani	1425	2440	3865	2156	2380	4536
61.	Barsuri	5210	2870	8080	7968	3830	11798
62.	Rudraprayag	17700	4129	21829	27093	5328	32421
63.	Khankara	2625	1100	3725	4010	1779	5799
64.	Sumerpur	Nil	837	837	Nil	855	855
65.	Ratura	Nil	2075	2075	Nil	3030	3030
66.	Molkakhal	4160	6170	10330	6375	12334	18707
67.	Gidokhal	Nil	560	560	Nil	760	760
68.	Chaunra	5510	3010	8520	8435	4310	12747
69.	Gadoli	11287	1710	12997	17250	2967	20217
70.	Tarpali	10800	1023	11823	16500	1042	17542
71.	Bungidhar	9562	7107	16669	14250	9364	23614
72.	Samoya	8537	4300	12837	13125	6100	19220
	Total	448900	194370	643270	682700	249110	931810

2. *Fodder from community forests.* The present Forest Act of U.P. does not permit grazing in the reserved forest areas. In the past, there have been uncontrolled lopping of trees and unrestricted grazing by the local people in the forest areas and this has brought considerable loss to the forest wealth. We feel that the situation is urgent enough for a strict enforcement of the Forest Act and have so recommended in the previous chapter. However, there are large areas situated between reserve forests and the present cultivated areas which are not suitable for agriculture. We have recommended in the previous chapter that these areas should be developed as community forest-cum-grazing land. This will provide fire wood to the villagers and grazing land for cattle living in areas surrounding the community forests. The cluster-wise areas of community forests have been indicated in the previous chapter.

Research by I.C.A.R.* has shown that one hectare of pasture land will provide an average out-turn of 75,000 kgs. of green fodder. Assuming that 50 per cent of the community forests will provide grazing lands, the total out-turn of green fodder for 1979 and 1984 will be about 4.5 lakh tonnes and 6.6 lakh tonnes, respectively. Cluster-wise production of fodder is shown in Table VIII.1.

* Indian Council of Agricultural Research, I.C.A.R. Publication, New Delhi, 1961.

Fodder requirement. The requirement of fodder can be considered from two angles. First, the roughages (crop residues) can be complemented by a large amount of green fodder. Secondly, the nutritional deficiency of roughages can be made up with concentrates such as grains and oil cakes. Of these two methods, the former seems to be best suited for Pauri. If our recommendations are implemented, quite a large area under pasture will be available for raising green fodder. Grazing is physically beneficial for the animals besides being the cheapest method of feeding.

The consumption of green fodder depends on the number of adult units in a flock, their breed and body weight. In a herd of 100 cattle, the animals in milk will be about 30-35 and the remaining will be heifers, calves and dry animals. For a milch animal, the fodder requirement will be 120 lbs. (545 kgs) and for the others it will vary from 60 lbs. (27.25 kgs.) to 10 lbs. (4.5 kgs.), according to the age of the animal. At this rate, the total fodder requirement for a herd of 100 cattles will be about 200 tonnes.**

Distribution of Milch Animals

The distribution of cattle in the tehsil would be based on the availability of fodder and pasture land. Commercial cattle rearing is, therefore, proposed in clusters which have large areas of pasture land and which are situated near the proposed Dairy Project at Satpuli.† In other areas, where the major source of fodder is the crop residue, animals could be reared for domestic use. It is also proposed that 25 per cent of all milch cattle should be the buffaloes. The number of cows and buffaloes that could be reared in the milk shed area of the Satpuli project and their production during 1979 and 1984 are shown in Table VIII.2.

TABLE VIII.2 : DISTRIBUTION OF MILCH ANIMALS AND MILK PRODUCTION IN THE MILK SHED AREA OF THE PROPOSED SATPULI DAIRY PROJECT, 1979 AND 1984

S.No.	Name of Cluster	1979			1984		
		Cattle	Buffaloes	Milk production* (in litres)	Cattle	Buffaloes	Milk production* (in litres)
1.	Baganikhal	1371	458	4350	2045	681	6466
2.	Diusi	1343	448	4252	2006	668	6348
3.	Ghandiyal	1008	336	3266	1572	524	4980
4.	Kanskhet	729	243	2306	1115	371	3624
5.	Nahsain	574	191	1814	912	304	2890
6.	Adhwani	203	67	642	323	107	1020
7.	Kaljikhal	405	135	1284	562	187	1776
8.	Saknikhet	129	43	406	222	75	708
9.	Banghat	972	324	3080	1508	503	4776
10.	Satpuli	1530	510	4848	2082	694	6598
11.	Kandarpani	1554	518	4920	2310	770	7310
12.	Mawadhar	725	241	2292	1080	360	3420
13.	Patisain	359	119	1140	458	152	1448
14.	Mundneshwar	223	75	708	262	87	826
15.	Piplipani	934	312	2962	1343	447	4250
	Total	12060	4020	38230	17800	5930	56440

* It is assumed that 35% of the cattle and 40% of buffaloes will be in milk.

** Banerjee, G.C., *A text book of Animal Husbandry*, Oxford and IBH Publishing Co., New Delhi, 1965.

† For details, see chapter on "Planning for Industrial Development" of this report.

Linking of Milk Production with Dairy Scheme

Because of the current shortfall in milk supply in the tehsil, more milk will be consumed once production increases. With the increased production of milk as contemplated in this report, there will now be surplus after local consumption. Keeping this in view, the milk production is proposed to be linked up with a dairy project at Satpuli which is centrally located in the district. The rated capacity of this dairy will be 40,000 litres and will be able to utilise surplus milk produced in the tehsil. This dairy plant will meet the demand of milk in all urban centres of the district. The milk shed area of this project will cover the tehsils of Pauri and Lansdowne. Assuming that 50 per cent of the production will go for domestic consumption, the supply of raw milk from Pauri tehsil will be 20,000 litres per day. A detailed study has to be made in the Lansdowne tehsil of the district to assess the potentiality of milk production there. It is assumed, however, that at least half of the requirement of the plant can be met from Lansdowne tehsil. The milk shed area in Pauri tehsil can be seen in Figure VIII.1.

Location of Milk Chilling Plants

Milk produced under ordinary village conditions is susceptible to bacterial action and has to be delivered to chilling plants within 3 to 4 hours from the time of milking. Milk will be cooled to a temperature of 40°F in these plants. The selected locations for the establishment of milk chilling plants and their respective capacities in the years 1979 and 1984 are shown in Table VIII.3.

TABLE VIII.3 : LOCATION OF CHILLING PLANTS AND COLLECTON OF MILK

S.No.	Location of chilling plant	Estimated collection of milk in litres	
		1979	1984
1.	Mundneshwar	2,000	3,000
2.	Kandarpani	4,000	6 000
3.	Adhwani	3,500	5,000
4.	Ghandiyal	6,000	9,000
5.	Satpuli	4,500	7,000
	Total	20,000	30,000

These chilling plants are proposed under the management of the milk producers cooperative society (the other functions of the society will be dealt with separately). The chilled milk will be transported in insulated tanks to the milk pasturisation plant at Satpuli by ropeways.*

Supply and Genetic Improvement of Cattle

The economic foundation of small producers in dairying can only be built around high producing milch animals. This requirement would be fulfilled mainly by cross-bred

* For details of the proposed ropeway, see chapter on 'Transportation'.

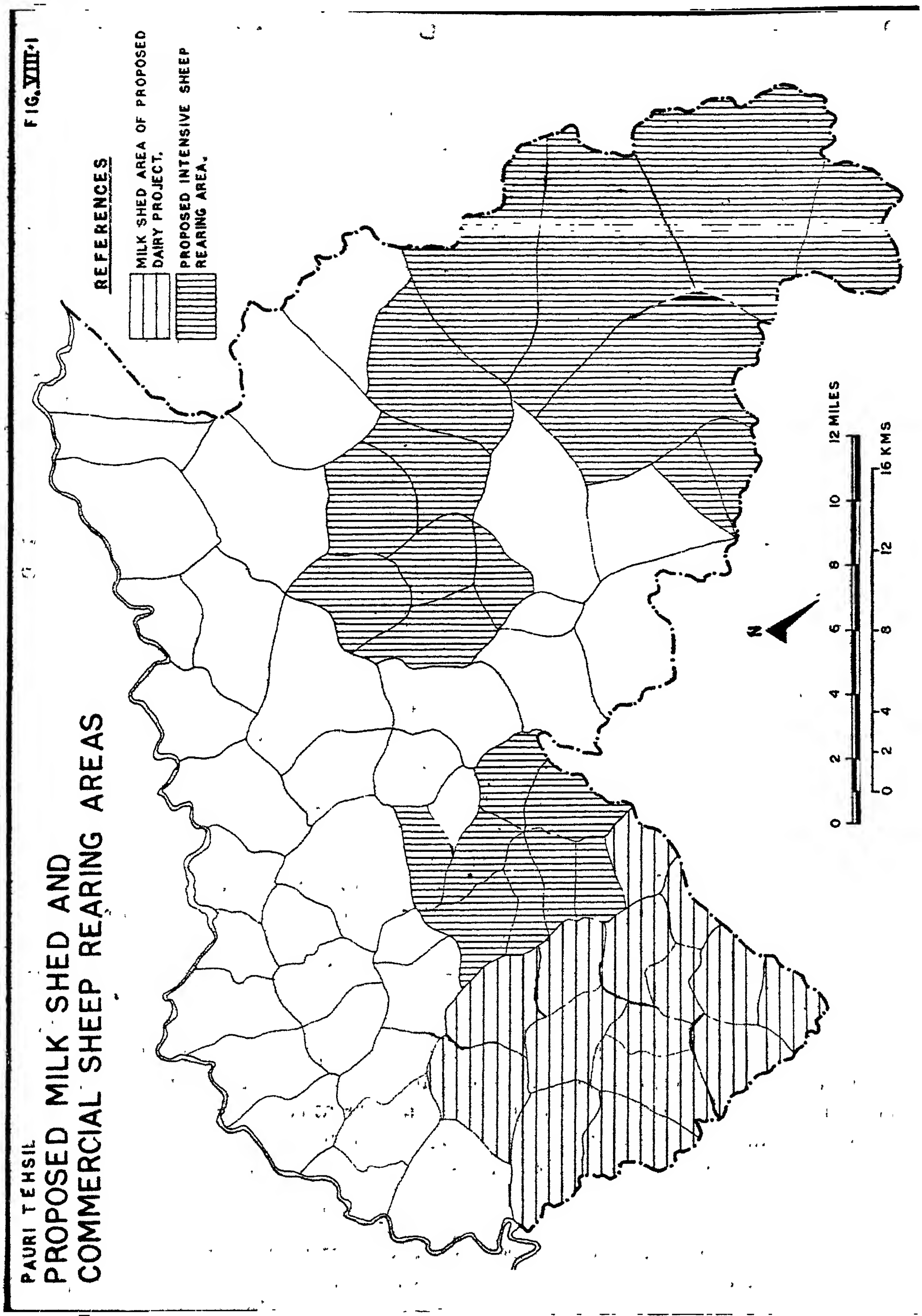
FIG. VIII-1
PAURI TEHSIL
PROPOSED MILK SHED AND COMMERCIAL SHEEP REARING AREAS
REFERENCES
MILK SHED AREA OF PROPOSED DAIRY PROJECT.
PROPOSED INTENSIVE SHEEP REARING AREA.
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

cows and high-yielding she-buffaloes. Theoretically speaking, the easiest way to achieve this would be to buy and supply high producing cross-bred cows and mature heifers to the farmers. But this is not possible because of short supply, heavy demand, transportation difficulties and the heavy financial investments involved. The only practical solution will be to plan a programme for the production of cross-bred cows and buffaloes by the small farmers who form a majority of cattle growers.

As a first step, an intensive selection of the existing stock has to be made on the basis of milk producing capacity and a system of progeny testing. The selected indigenous cows pure-bred or non-descript has to be cross-bred with grade bulls of exotic dairy breeds. As regards the exotic bulls the Scientists' Panel on Animal Husbandry of the Ministry of Agriculture has recommended that the bulk of the exotic inheritance could be obtained through the Jersey breed. Considering the topography and the climate, the Jersey breed seems to be the best. The size is comparatively smaller and the fat content in milk is also higher. Other exotic breeds that can be used are Holstein, Broun Swiss, Red Dame, etc. If an exotic dairy breed with an average of 4,000 kgms per lactation is used for cross breeding with local cattle with an average of 1,000 kg. per lactation, the first generation cross could be expected to produce 2,000—2,500 kgms. From the available information and studies regarding the level at which exotic inheritance stabilizes is 50 to 62.5 per cent.

An intensive artificial insemination programme for cross breeding of cows will bring a rapid regeneration. It has been estimated by the National Dairy Development Corporation that one exotic dairy bull will be needed for the artificial insemination of 1,000 cows. Based on this norm at least 15 exotic bulls, one in each cluster should be made available in the milk shed area. Another 30 cows of exotic breed will also be needed to establish foundation herds with a view to covering exigencies and for the production of exotic bulls. The State Animal Husbandry Department should take immediate action to purchase these bulls and cows. With the proposed programme of artificial insemination, 40 per cent of the farmers will have cross-bred heifers as a result of the first round of artificial insemination allowing a margin for sex ratio, mortality, etc. Another equal number of farmers may be expected to have cross-bred heifer calves during the second round of artificial insemination which may be two years hence. It is expected that a number of farmers could also get a second crop of cross-bred heifer calves in a period of another two years.

Because of the high altitude and climatic conditions, Pauri is quite suitable for rearing of cross-bred cattle like the Malnad in South India. There is good scope in these areas for implementing a project of heifer production up to weaning stage for supplying to milk project areas in plains.

We have already mentioned that 25 per cent of milch animals should be buffaloes. Buffaloes will also play an important part in the dairy development scheme. As the objective of the milk production enhancement scheme is to help small and marginal farmers, it is proposed that those who possess buffaloes should also be assisted. A programme of selective breeding with the use of superior bulls of high pedigree should be taken up. For this, grading up with superior bulls of breed like Murrah, Surti, etc. are proposed.

Financial Assistance

The farmers should be encouraged to rear their cross-bred heifers properly so that they can replace the indigenous low producing cows. If the cross-bred heifers are properly reared and fed, they could be expected to take the bull at around 18 months of age and come

into production. It has been estimated that the cost of feeding up to the production time would be around Rs 960.* It is proposed that the small and marginal farmers who have produced heifers be extended financial assistance in the form of half subsidiary and half loan. This would mean that each farmer could get Rs. 480 as subsidiy and Rs. 480 as loan. This approach would be better than asking farmers to buy cows at a higher price even with a subsidy of 25 or 33⅓ per cent as provided in the SFDA/MFAL projects. Repayments of loan should start only after the animal starts giving milk. The loan may be made repayable in three years starting from the time the cow gives milk. The loan may be adjusted against the daily payment for the supply of milk in the proposed milk collection units.

Dairy Cooperative System

The cattle development programme as outlined above will help farmers develop their own cross-bred heifers through an artificial insemination programme. The programme also suggests improvement of buffaloes through better husbandry practices and distribution of salvaged superior buffalo cows. Medium term credit will be required by the farmers to supplement whatever feed is locally available. For this purpose, the functional cooperative system appears to be the best. Primary cooperatives have been proposed in all the central villages where milk production on a commercial scale has been proposed (Table IX.2). All these primary cooperatives should be linked up with the cooperative union at the district level with its headquarters at Satpuli. The cooperatives will arrange for the collection of milk and its supply under contract to the processing plant run by the union. Arrangements must be made for the daily payment for the milk supplied to them. The cooperatives must also adjust part of the price paid for the milk against capital and interest on the loans given to the member. The district union should arrange for the collection of milk from the primaries and run a feed plant at Satpuli for supply of concentrates through the primaries. It should maintain veterinary and animal husbandry services and artificial insemination in addition to providing credit to primaries. The functional cooperative system for milk supply was considered by the Rural Credit Review Committee (Venkatappiah Committee 1969) and was approved.

Insurance Cover

As a general principle, insurance of cattle should be encouraged. The high rate of premia currently charged by the insurance agencies discourages farmers from insuring their animals. The issue should be examined by the government. The credit giving agencies may lower the rate of interest on loans advanced in respect of insured animals.

Animal Health Cover

The implementation of the programme of cattle development involves the handling of a large number of high producing animals and hence the necessity of providing an adequate animal health cover needs no special emphasis. It is proposed that each central village should have a veterinary dispensary and in each service centre one veterinary hospital.

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* The cost of feeding, financial assistance to the small and marginal farmers is proposed on the basis of the recommendation of the National Commission on Agriculture, Government of India.

SHEEP DEVELOPMENT

Problems and Prospects

Like cattle, sheep rearing is also practised as a subsidiary occupation in the tehsil. The average size of sheep stock per farmer is very small although almost every farmer keeps a few heads of sheep. Except in Thailisain where sheep rearing is conducted on a commercial scale, in the rest of the tehsil, it is practised only for meeting the needs of individual families. Sheep raised in the area are mainly of indigenous breed with an extremely low average yield of 0.8 Kg. of wool a year. The average per annum yield of an improved breed of sheep is 5 to 6 Kg. of wool. Obviously, this low yield can be vastly improved if new methods of improved breeding, feeding and management are introduced among the farmers. There are practically no facilities for marketing wool and little incentives are available for wool-based cottage industries. Training facilities for scientific shearing, classification and grading of wool are also non-existent.

The National Commission on Agriculture, Government of India, has selected Pauri district as one of the eight districts in U.P. for an intensive sheep development programme. The natural conditions available in Garhwal hills are specially suited to raising superior woollen types of sheep.* The high altitude and cool climate are quite favourable for bringing about genetic improvements in sheep. With the improvement of the stock, the production of both wool and meat will increase. Wool, unlike many animal products can be stored indefinitely and if adequate storage space is made available, farmers can sell wool at a time convenient to them. There is no dearth of demand for wool either in the country or in the district. Aside from the local population, a large number of army and civil personnel posted in the area require heavy woollen clothes during winter. They are also the most important consumers of meat.

Sheep rearing does not involve heavy investments either in buildings or in equipments. Sheep thrive on herbs which grow in abundance in the forests. The time interval between two shearings of wool is not long and lambs can be marketed at the age of 6 to 8 months. Thus sheep rearing also brings relatively quick returns. For these reasons, it should be an ideal subsidiary occupation for small and marginal farmers. If programmes for sheep development are planned and managed well, sheep rearing may eventually become the primary occupation for many farmers of this area.

A Proposed Programme for Sheep Development

It has already been mentioned that the National Commission on Agriculture has recommended Garhwal district as one of the few districts in U.P. for intensive development of sheep. The programme suggests that a minimum of 3,000 families should be assisted in the district for improving the quality and production of their sheep. Considering the vast area under forests (for herbs) and the size of the proposed grazing lands, we propose that at least 1,500 families to be assisted under this scheme should be from the Pauri tehsil. The development programme has to be phased in such a way that 700 families will be induced to take up sheep rearing as a subsidiary occupation during the first five years of the plan period and the remaining during the second phase.

The development programme should aim at improving the productive capacity of the flocks already owned by the farmers. Along with this, good quality sheep must be made

* Sen, S.K., *Handbook of Animal Husbandry*, Indian Council of Agricultural Research, New Delhi, 1962.

available on a subsidised price. In sheep, genetic improvements can be brought about easily and quickly as the characteristics of sheep are highly inheritable. Exotic breeds such as 'Rambouillet' and 'Merinos' are found quite suitable for cross breeding and the inheritance level can be raised up to 75 per cent as has been done in Kashmir valleys. The programme for assistance should be carried out on the following lines.

Each identified farmer should be assisted to own a flock of 20 improved ewes and one ram. One such unit of sheep is estimated to give an annual income of Rs. 580 for the woolly type and Rs 420 for the mutton type.* Flock owners who possess more than 20 local type ewes may be induced to cull and dispose of the inferior type and replace them with improved ewes and rams provided under the programme. Those who possess smaller flocks may be encouraged to strengthen their flocks with the addition of improved sheep. Farmers who would come forward to take up sheep rearing in those areas where there is sufficient grazing land should be assisted to own a unit of 10 improved sheep in the first year and another 10 in the next year.

The number of families to be assisted for sheep rearing in each cluster by 1979 and 1984 are worked out on the basis of the availability of grazing land as shown in Table VIII.4. It is also expected that in addition to the 1,500 families proposed to be assisted by 1984, another 1,500 families will take up this subsidiary occupation on self-supporting basis through cooperatives. The total number of sheep to be reared by 1979 and 1984 will be 31,600 and 63,200, respectively. It is also proposed that 75 per cent of the total sheep should be of the woolly type and the remaining mutton type.

The annual production of wool and mutton is estimated and shown in Table VIII.4. It is calculated that a unit of 20 sheep and 7 yearling lambs will produce 45.5 kg. **wool annually. The production of mutton from a unit of 20 sheep by its rams lambs will be about 50 Kg.

For the implementation of this programme, a large number of improved type of ewes and rams will be required. The State Department of Animal Husbandry should take up the responsibility of supplying them from government farms and private sources to the proposed sheep breeding and wool producing cooperative societies for further distribution to the farmer. As the envisaged programme involves rearing of a large number of improved indigenous and cross-bred sheep, it requires an effective health coverage.

Credit and Marketing Facilities

At present the wool produced by the farmers is either kept for domestic use or traded through the middle-man who keeps most of the profit. With the intensive programme of sheep rearing, the production of wool will be much higher and the marketing of wool should be organised by the farmers themselves. For this purpose, sheep rearers' primary cooperatives are proposed at 22 centres which will be federated into the district-union proposed at Thailisain(see Table VIII.4). The primary cooperatives should be closely associated with every phase of sheep and wool development projects. These primary societies should distribute grants and loans proposed for the small and marginal farmers and production credit to the sheep farmers. Wool grading and disposal centres are also proposed in Parsundakhal and Thailisain. Special arrangements should be made in these two centres for training

* Based on the estimates of National Commission on Agriculture, Government of India.

** National Commission on Agriculture, Govt. of India, *Interim Report on Poultry and Sheep Production through Small and Marginal Farmers*, New Delhi, 1973.

younger educated artisans in the latest spinning and weaving methods making use of better quality wool. Industries based on wool have been proposed in the next chapter.

TABLE VIII.4 NUMBER OF FAMILIES TO BE ASSISTED IN SHEEP REARING AND THE PRODUCTION OF WOOL and MUTTON, 1979 & 1984

S No.	Name of Cluster	1979				1984				Collection and processing centre
		No. of families to be assisted	Total No. of sheep	Production (in tonnes)		No of families to be assisted	Total No. of sheep	Production (in tonnes)		
				Wool	Mutton			Wool	Mutton	
1	Jakheti	28	1250	2 50	2.8	59	2500	5.00	5 6	Parsundakha
2.	Agroia	28	1250	2 50	2.8	59	2500	5 00	5.6	,,
3	Paidul	13	600	1.10	1.3	28	1200	2.20	2.6	,,
4.	Parsundakhal	31	1400	2 80	3.1	67	2800	5.60	6.2	,,
5.	Kandara	28	1250	2.50	2.8	59	2500	5.00	5.6	,,
6.	Bubakhal	33	1500	3.00	3.3	71	3000	6 00	6.6	,,
7.	Sikukhal	43	1950	3.90	4 3	92	3900	7.80	8.6	,,
8.	Pokhrikhit	50	2300	4.50	5.0	109	4600	9 00	10 0	,,
9.	Mailisain	19	900	1.70	1 9	41	1800	3·40	3.80	Thailisain
10.	Chifalghat	69	3100	6.10	6.9	148	6200	12.20	13.80	,,
11.	Sankarsain	17	750	1.50	1.7	36	1500	3.00	3.4	,,
12.	Cholusain	13	600	1.10	1.3	29	1200	2.00	2.6	,,
13.	Pokhri	6	250	0 50	0.6	12	500	1.00	1.2	,,
14.	Bhira	40	1800	3.66	4.0	86	3600	7.20	8.0	,,
15.	Thailisain	34	1500	3.00	3.4	72	3000	6.00	6.8	,,
16.	Chakisain	34	1500	3.00	3.4	72	3000	6.00	6.8	,,
17.	Paithani	6	300	0.50	0.6	14	600	1.00	1.2	,,
18.	Chaunra	25	1100	2.28	2.5	53	2200	4.40	5.0	,,
19.	Gadoli	51	2350	4.60	5.1	111	4700	9.20	10.2	,,
20.	Tarpali	49	2250	4 40	4.9	105	4500	8.80	9.8	,,
21.	Bungidhar	43	1950	3.90	4.3	93	3900	7.80	8.6	,,
22.	Samoya	40	1750	3.60	4.0	83	3500	7.20	8.0	,,
	Total	700	31600	63.00	70.00	1500	63200	126.00	141.00	

POULTRY DEVELOPMENT

Problems and Prospects

Poultry farming could also provide a subsidiary occupation to the farmers although organised poultry development on a commercial scale has yet to be started in the tehsil. Farmers keep small flocks of 5 to 10 birds of mostly indigenous breeds. These are mainly kept for meeting family requirements of eggs and poultry meat but do not provide any substantial income. Improved types of chicks, birds, feed and equipment for organised poultry

rearing have to be brought into the tehsil from outside. Financial assistance in the form of credit and subsidy and extension services in the form of routine vaccination, disease control and treatment are also inadequate in the tehsil.

Poultry farming requires very little investment in land and equipments. The investment is even smaller than investments on sheep rearing. Poultry farming can be started on a small scale and then expanded gradually. Chicken coops can be built with locally available materials. Equipments for feeding, watering, etc. can be manufactured in the village itself. Improved local poultry survive well on coarse grains and agricultural by-products and do not have to be given expensive high feeds. An additional advantage of poultry farming is that the capital invested starts paying back within a short interval. This ensures a steady income throughout the year. With the help of the deep litter method, poultry raising can also produce valuable manures for the fields.

A Proposed Programme for Poultry Development

It has already been mentioned that most of the farmers in the tehsil own small flocks of 5-6 birds for their domestic requirements. So the demand for eggs from commercialised poultry farms will be from the urban centres, army camps, hospital and hotels. The bulk of the consumption will be in the urban areas. As per the 1971 census, the urban population in the tehsil was about 15,000 persons. It is estimated that about 50 per cent of the urban population will be potential consumers of eggs and at the rate of 1 egg per person per day the requirement will be 7,500 eggs per day. This demand is at present partly met by collecting eggs from the interior villages and transporting them at a high cost to the urban areas. There is also a good demand in the army camps, hospitals and hotels. Considering the lack of transportation facility in the tehsil, we propose that the above requirement of eggs should be met by developing commercial poultry farms in close proximity to the consumption centres.

To start with, the object will be to produce 10,000 eggs and 300 table birds per day and this will be doubled by 1984. The projects will be located in five clusters namely, Pauri, Srinagar, Rudraprayag, Bahbazar and Satpuli.

The selection of the actual sites for these poultry farms should be based on the following criteria : (1) nearness to a major consumption centre such as a town or an army camp; (2) availability of electricity for practising improved methods of poultry farming; and (3) the interest of the local people.

With the proper management, better feeding and housing, it is expected that each hen will lay at least 144 eggs in an year and hence 25,000 laying birds will be required to produce 10,000 eggs per day. It usually takes $2\frac{1}{2}$ to 3 chicks to raise one laying hen. Based on the fact that half the number of chicks will be males and there will be some mortality, it is estimated 75,000 day-old chicks will be required to produce 25,000 laying hens. As the economic value of the laying hens is usually one laying per year, almost 100 per cent stock will have to be replaced every year. Thus 25,000 female birds will be available for table in addition to the 25,000 male birds. This provides, at an average, 100 birds per day. To produce another 200 table birds per day or 73,000 birds per annum, another 65,000 day-old chicks of meat type will also be required. So the annual production of chicks will be 1,60,000.

To maintain this tempo of production, five incubators of 8,000 eggs capacity will be required. It is proposed to install one each at Pauri, Srinagar, Rudraprayag, Bahbazar

and Satpuli. The poultry feed requirement based on the consumption per bird and the period expected to be retained is estimated as 2,000 tonnes per annum at the rate of 6 tons per day.

As mentioned earlier, five commercial poultry farming projects are proposed in the Pauri, Srinagar, Rudraprayag, Bahbazar and Satpuli clusters. It is expected that 50 families will get gainful employment and each will maintain a unit of 100 layers. The monthly income will range from Rs. 50-100. The project will be on commercial lines on self-supporting basis through cooperatives. The incubators will be under the management of cooperatives and this organisation should supply the day-old chicks, feed, drugs, etc. and should market eggs and poultry.

CHAPTER IX

PLANNING FOR INDUSTRIAL DEVELOPMENT

In the previous chapters, we have analyzed the causes of economic backwardness of the study area and examined the possibilities of developing its vast natural resources for the benefit of the local people. The potentialities of the area are indeed great and the virgin resources can be developed through agriculture, horticulture, forestry, sericulture, animal husbandry and other allied activities.

But this is only half the story. The vast raw materials which will be produced through these efforts will have to be processed and the area can certainly look forward to an impressive beginning in industrial activities. There are a few reasons why we favour industrial processing of the raw materials locally instead of transporting them to processing plants in the plains. First, due to the topography of the land and a primitive transportation system, it is much easier to process the bulky raw materials locally and send out processed goods for local and outside consumption. Some of the processed goods such as milled rice and flour, pasteurized milk, woollen products, fruit products and meat are badly needed by the local people. At present they are either imported from outside at high cost which very few can afford or not used at all. Products of enormous economic value to the outside world such as pulp, board, newsprint, timber, resin, raw silk, preserved fruit products and herbs can bring scarce cash money to the area.

Of more topical interest is the employment potentiality of industrialization. At present, employment opportunities are so meagre that a sizeable proportion of the working force regularly migrate to other parts of the country seeking jobs and 84 per cent of the remaining work force depend for their livelihood on agriculture. A planned industrialization programme based on the natural resources of the area will certainly provide alternative job opportunities.

It must be pointed out that the programme for industrial development suggested in thischapter will only be possible if the natural resources are developed first.The plan presented in this report is based on an integrated development of all resources. We have emphasized earlier that one sector cannot be developed without a concomitant development in other sectors. Thus in making recommendations for industries in the tehsil, we assume that our recommendations for the development of agiiculture, horticulture, forestry, sericulture and animal husbandry will be implemented.

Present status of industrial development in Pauri Tehsil. The very poor industrial development of the study area is an accurate indicator of the general economic backwardness of this hill district. Of the 44 small-scale industries in the whole district in 1971, only four units were located in the tehsil. Primarily, these are consumer based industries and most of them are located at Kotdwara in Lansdowne tehsil.

Three of the four small-scale industries in the tehsil are located in Pauri and the remaining one at Srinagar. The industries in Pauri are the rosin and turpentine manufacturin unit, the shawl weaving centre and the woollen rug manufacturing unit.

The raw material for the rosin and turpentine factory is the rosin tapped from pine trees and is supplied by the forest department from the local forests. The raw material

requirement of this unit during 1971 was about 180 tonnes. The rosin and turpentine produced was exported outside the district. The main consumers of rosin are the paper, soap, paint and varnish industries located in the major urban centres of the state. The sale value of rosin and turpentine from this factory during 1971-72 was Rs. 4 lakhs and Rs. 0 54 lakhs, respectively and the number of workers were 12

The shawl weaving centre at Pauri is under the Indsutrial Development Board. Fine wool collected from various parts of the tehsil is used as raw material. The products are mainly sold in Uttarkashi and Chamoli districts. The value of production in this unit during 1971-72 was Rs. 50,000 and the number of employees was eight.

The woollen rug manufacturing unit is also in the public sector and under the Khadi Board. The raw material required in this unit is collected from Pauri and Thailisain blocks. Both fine and coarse woollen textiles are manufactured in this unit. The defence force stationed in and around the tehsil are the main consumers of these woollen goods. The value of the annual production of this unit was about Rs. 50,000 in 1971-72 and the number of employees was 13.

The only other unit is the wood-based industry attached to the Industrial Training Centre at Srinagar. Here wood-based stationery and other utility articles are manufactured. The raw material required for this unit is supplied by the forest department from the nearby forests. This unit is a production-cum-training centre and the number of employees during 1971-72 was 24.

A few cottage industries of the household type are scattered all over the tehsil. They are predominantly blanket weaving, leather foot wearing, tailoring and blacksmith units.

Prospects of industrial development in the tehsil. Before suggesting a programme for industrial development it is worthwhile to make a broad assessment of the industrial possibilities in the tehsil. In doing so we have examined various factors which are likely to influence industrial development in this area. Some of these factors are the availability of local raw materials from various sectors such as agriculture, livestock, horticulture, forests, minerals, etc. the demand for various products both within and outside the tehsil and the availability of infrastructure.

Resource base. The industrial possibilities in the tehsil will be largely determined by the availability of various raw materials locally. We have already mentioned the total absence of information on mineral resources of the area although some deposits are known to exist. Without a precise evaluation of the quantum of these resources and whether it is large enough to be economical, no recommendation for their mining and processing can be made. A plan for mineral-based industries will, therefore, has to wait until such information is available.

The existing position andt he scope of future development of various other resources in the tehsil have already been examined in detail in the previous chapters. The tehsil with two-thirds of its area under forests will provide a large variety of timber of commercial value. The potentiality for the development of sericulture and horticulture is also extremely promising. Although only a limited amount of additional agriculture land can be made available in the coming years, the proposed irrigation schemes and the use, even on a modest scale, of improved seeds, fertilizers, pesticides and other practices, will considerably reduce the present food deficit in the teshil by 1979 and a fair surplus will be available by 1984. The proposed animal husbandry programme will also initiate commercialised cattle and sheep rearing and poultry farming in this area. Once developed, these resources will provide a

solid base for a fair number of industries such as pulp, paper and wood manufacturing, fruit preservation and processing, dairy, woollen textiles and other sericultural and agro-based industries. The demand for the products of some of these industries is almost guaranteed. There is acute shortage of products such as timber, newsprint, writing paper, pulp, milk products, fine wool, silk and a number of fruit products in the country today. Some of these products are also potential foreign exchange earners.

Infrastructure Aside from the locala vailability of raw materials, locational decisions for the establishment of specific industries will have to be based on the availability of a number of infrastructural facilities such as land, water, power, transport, entrepreneurship, etc. A general picture of the extent to which the various infrastructural facilities are available in the tehsil is attempted below. It may be emphasized that the conjunction of the various infrastructural facilities at one place and not their aggregate availability at different places in the study area that will contribute to the development of industries.

(*i*) *Land.* Land, by itself, is not a constraint for industrial development in the tehsil. Even though the physical landscape of the tehsil is characterised by rugged mountainious terrain, land suitable for industrial development is available in the tehsil in various locations within reasonable distance from roads and waterways.

(*ii*) *Water.* There is abundant quantity of seasonal water flow in the numerous rivers of the tehsil. It can be made available for industrial use by construction of reservoirs at appropriate points along the river courses. If the various proposed irrigation schemes are coordinated with industrial and power projects, there is prospect of abundant water supply in many locations where industries can be established.

(*iii*) *Power.* Power supply in the tehsil is extremely inadequate at present and at the present rate, there is no chance of any industrial development here. Electricity is available only in the urban areas and in a few important rural centres. In the last chapter of this report, we have recommended an extensive rural electrification programme for the area. If implemented, this programme will electrify all central villages and service centres where most of industries are proposed.

(*iv*) *Transportation.* The tehsil is not connected by the railways. The road system is also quite inadequate as it does not serve much of the important resource areas such as forests, agricultural and horticultural areas. The rivers do play an important role in the transportation of the timber freshly cut from the forests but this needs to be supplemented by road transport. A close coordination between industrial development and the development of a well-coordinated transport system is essential. Recommendations for such a transportation system have been made in the chapter on transportation of this report.

(*v*) *Entrepreneurship.* The tehsil suffers from the lack of adequate supply of capital and incentives for entrepreneurship. However, this deficiency need not be met locally. If favourable conditions are created and necessary infrastructure is built up, entrepreneurs from outside the tehsil would step in and be prepared to take advantage of the available facilities. The inflow of outside capital and entrepreneurship should, however, be permitted with caution. This should, under no circumstances, be exploitative and should not inhibit and prevent local entrepreneruship to grow. In licensing industrial plants in the area, the first preference must be given to local entrepreneurs and adequate credit should be made available. Some industries should remain in the public, joint or the cooperative sectors depending on the nature of the industry in question. The issue has been discussed later in the chapter. In the chapter on social facilities, we have also discussed the need for training of local skills.

A proposed programme for industrial development. The foregoing analysis shows that there are enough potentialities for industrial development provided the infrastructure deficiencies can be met. Proposals for infrastructure development have been made in the respetive chapters. The following industries have been proposed on the assumption that the infrartructural gaps will be filled in due course of time.

Agro-based industries. There is an urgent need to strengthen the link between agriculture and industry and to evolve a strategy for ensuring a dynamic development of agro-industries in the teshil. We have already seen that the two major food crops, rice and wheat will be marginally deficit in 1979 and surplus in 1984 while most other crops will show surpluses in both the years. However, the total produce will have to be processed for consumption. A certain percentage of paddy will be kept for seeds and for hand pounding but the remaining stock will have to be milled. The availability of rice mill in the area may even encouraged, farmers for keeping more paddy for milling. Wheat also has to be ground. There is need, therefore, for a number of processing units regardless of the status of food supply in the tehsil.

Rice mills. The annual production of paddy during 1979 and 1984 in the tehsil is estimated as 46,300 tonnes and 82,000 tonnes, respectively. At present there are no rice mills in the tehsil and almost all the rice produced goes for hand pounding. With the introduction of electricity, potential will be created in the area for rice mills to take over a large proportion of the volume which is now currently hand pounded.

There are three types of rice milling machinery: (1) the traditional huller type, (2) the sheller type and (3) the modern rice mill. The modern rice mill has many advantages over the other two. These mills have mechanical dryers, paddy cleaners, separators, bulk storage aisles and the most modern parboiling system. Clean rice with very few brokens is obtained with this mill equipment.

Mini-rice mills. Modern rice mill plants are available in various capacities. The range varies from 200 to 250 Kgms per hour to large mills of 3 tonnes per hour capacity. In the study area, owing to the difficulties in transportation and scattered location of settlements it is desirable to install small capacity rice mills for serving small areas. Mini-rice mills with an annual milling capacity of 600-750 tonnes seem ideally suited to the conditions of the study area.* It is also to be noted that the availability of paddy (after subtracting amounts for seeds and hand pounding) in the hinterlands of most of the central villages falls within the above range. Central villages with paddy growing hinterlands and with road connections with their tributary villages, will, therefore, be ideal sites for these mini-rice mills.

Making allowances for seed requirements and the amount which will be hand-pounded, it can be assumed that at least 40 per cent of the total production will find its way to the rice mills. Based on this proportion, cluster-wise availability of paddy for milling has been calculated for the years 1979 and 1984 (Appendix IX.1). Clusters having an input of more than 600 tonnes per year will be eligible to have a mini-rice mill. Clusters where production falls short of 600 tonnes are clubbed with the nearby clusters and for every 600 tonnes, one mini-rice mill is proposed. While proposing a rice mill for a group of clusters due attention has been given to locate it preferably in the service centres. Location of proposed rice mills, estimated collection of paddy, centres to be served are shown in Table IX.1.

*Nagaiya, D., *Profile of Mini Rice Mills*, SIET Institute, Hyderabad (Mimeo.)

TABLE IX.1 : LOCATION AND NUMBER OF PROPOSED RICE MILLS IN PAURI TEHSIL

S. No.	Name of Centre	Number of proposed rice mills		Total
		1974—79	1979—84	
1.	Bahbazar	—	1	1
2.	Ghandiyal	1	—	1
3.	Kanskhet	—	1	1
4.	Safdarkhal	1	—	1
5.	Kot	1	—	1
6.	Satpuli	1	—	1
7.	Parsundakhal	1	—	1
8.	Pauri	1	—	1
9.	Kirtinagar	—	1	1
10.	Srinagar	1	—	1
11.	Pokhrikhet	—	1	1
12.	Khirsu	1	1	2
13.	Kherakhal	—	1	1
14.	Chifalghat	—	1	1
15.	Bhira	1	—	1
16.	Thailisain	1	—	1
17.	Chakisain	1	—	1
18.	Rudraprayag	1	—	1
	Total	12	7	19

It can be seen fromTable IX.1 that for the periods 1974-79 and 1979-84, 12 and 7 mini-rice mills have been proposed. The cumulative number of mini-rice mills that could be established by 1984 is, therefore, 19. The actual location of these mills will be 18 central villages some of which are also service centres and growth centres. Each of these places will have one mill with the exception of Khirsu which will have two mills.

A mini-rice mill with an installed capacity of 200 to 250 Kgs. per hour requires an investment of Rs. 27,500 and this can be worked with an electric 10 HP motor.

Flour mills. In the study areas, in addition to wheat, almost an equal quantity of mandua (a substitute for wheat) will need grinding. At present grinding is mostly done in domestic chakkies. There are six flour mills now in the tehsil. Of these, two are located at Pauri and one each in Srinagar, Satpuli, Rudraprayag and Kanskhet. Cluster-wise estimation of wheat and mandua during 1979 and 1984 and the anticipated consumption (Appendix IX.2) indicates that there will be marginal surpluses of these two crops. Since the surplus quantity is likely to go to the market as cereals, the estimation of required number of flour mills is made on the basis of consumption. It is estimated that the total consumption of wheat and mandua during 1979 and 1984 will be 26,400 tonnes and 28,100 tonnes, respectively, and these amounts will have to be processed. Even in the event of a deficit in the production of these two crops, the deficit will be made up with imported grains which are expected to arrive in the whole form and will also have to be processed.

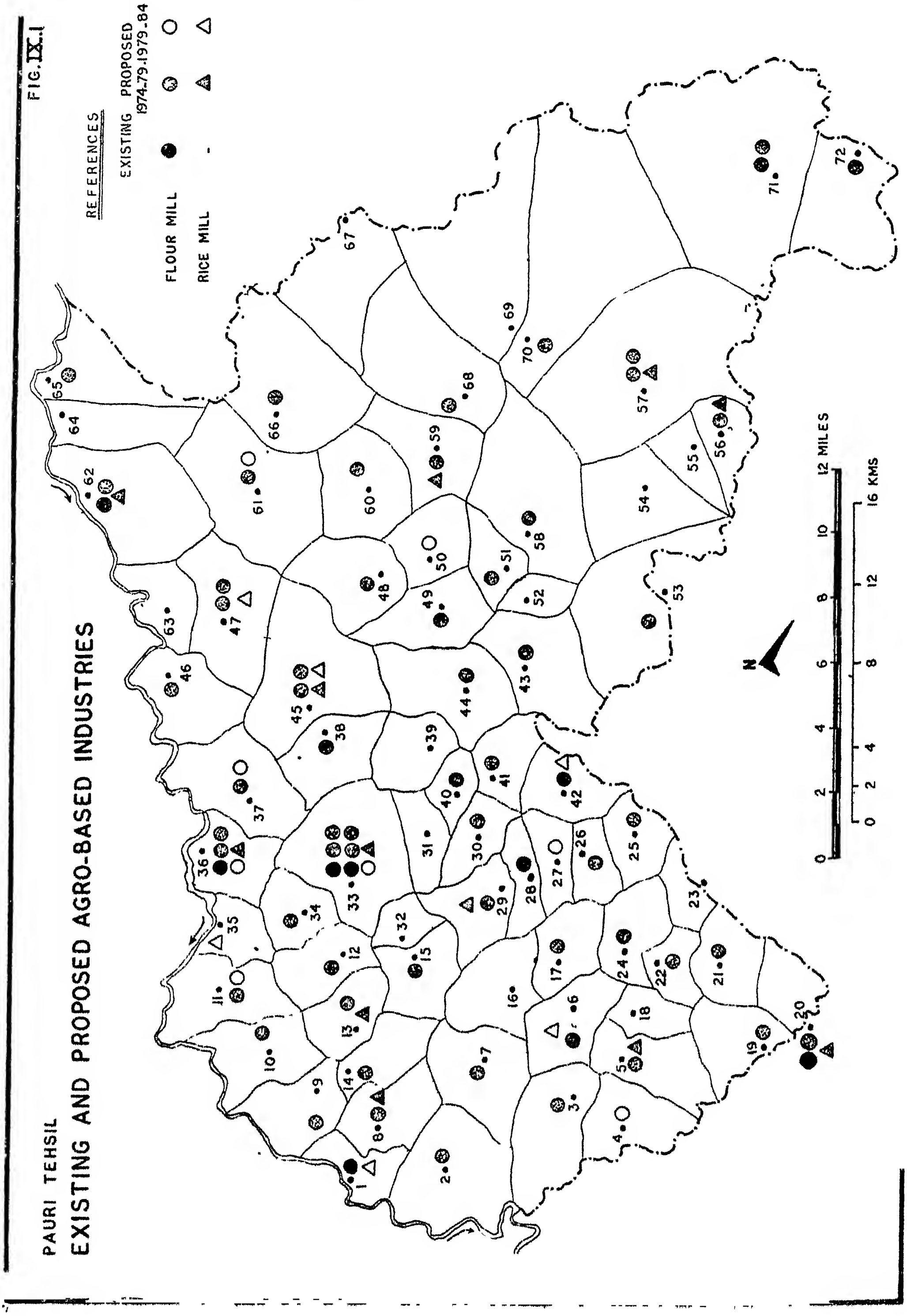
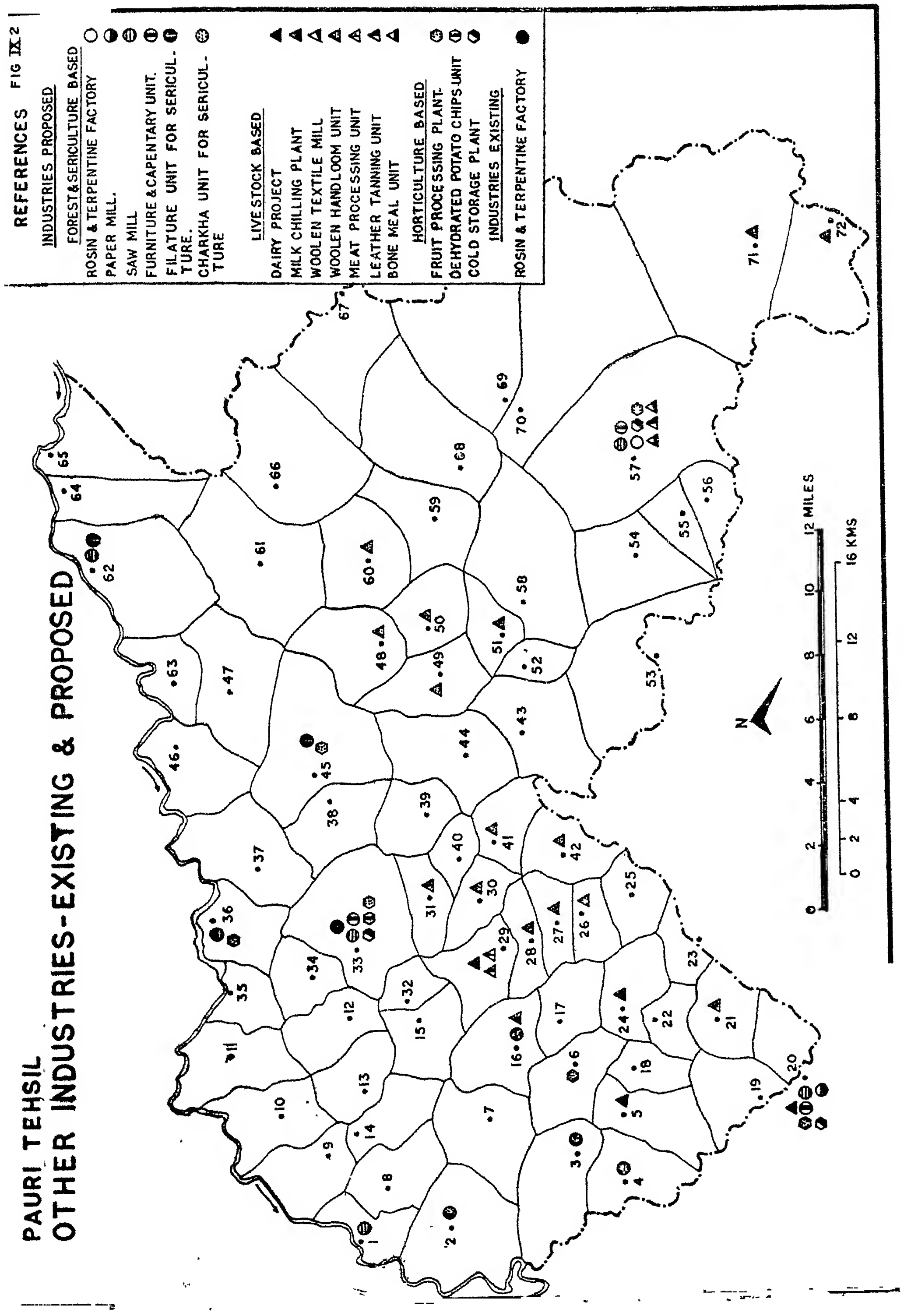


FIG. IX.1
PAURI TEHSIL
EXISTING AND PROPOSED AGRO-BASED INDUSTRIES
REFERENCES
EXISTING
PROPOSED 1974-79.1979-84
FLOUR MILL
RICE MILL
N
12 MILES
16 KMS


PAURI TEHSIL
OTHER INDUSTRIES-EXISTING & PROPOSED
FIG IX 2
REFERENCES
INDUSTRIES PROPOSED
FOREST & SERICULTURE BASED
ROSIN & TERPENTINE FACTORY
PAPER MILL.
SAW MILL
FURNITURE & CAPENTARY UNIT.
FILATURE UNIT FOR SERICULTURE.
CHARKHA UNIT FOR SERICULTURE
LIVE STOCK BASED
DAIRY PROJECT
MILK CHILLING PLANT
WOOLEN TEXTILE MILL
WOOLEN HANDLOOM UNIT
MEAT PROCESSING UNIT
LEATHER TANNING UNIT
BONE MEAL UNIT
HORTICULTURE BASED
FRUIT PROCESSING PLANT.
DEHYDRATED POTATO CHIPS UNIT
COLD STORAGE PLANT
INDUSTRIES EXISTING
ROSIN & TERPENTINE FACTORY
12 MILES
16 KMS
N

The cluster-wise consumption figures indicate that there is scope for small flour mills. In a hill areas like Pauri it is not advisable to install large flour mills to cater to the needs of a few clusters only. Our proposal is to establish small flour mills of one ton per day capacity in those central villages where the anticipated consumption of wheat and mandua is more than 300 tonnes. Clusters with small populations and low consumption, are clubbed with contiguous clusters for planning purposes and mills have been proposed in one of the central villages which can conveniently serve the constituent clusters. In selecting central villages for this purpose, people's space preference for second order functions and accessibility have been considered.* Table IX. 2 shows the proposed location of flour mills in the tehsil.

TABLE IX.2 : NUMBER OF EXISTING AND PROPOSED FLOUR MILLS—PAURI TEHSIL

S. No.	Name of the Centre	Existing	Proposed 1974—79	Proposed 1979—84	Total 1984
1	2	3	4	5	6
1.	Bahbazar	1	—	—	1
2.	Ghindwara	—	1	—	1
3.	Baganikhal	—	1	—	1
4.	Diusi	—	—	1	1
5.	Ghandiyal	—	1	—	1
6.	Kanskhet	1	—	—	1
7.	Nahsain	—	1	—	1
8.	Safdarkhal	—	1	—	1
9.	Kamalpur	—	1	—	1
10.	Jamlakhal	—	1	—	1
11.	Dechaunri	—	1	1	2
12.	Khandiunsain	—	1	—	1
13.	Kot	—	1	—	1
14.	Khelchaunri	—	1	—	1
15.	Lwali	—	1	—	1
16.	Adhwani	—	—	—	—
17.	Kaljikhal	—	1	—	1
18.	Saknikhet	—	—	—	—
19.	Banghat	—	1	—	1
20.	Satpuli	1	1	—	2
21.	Kandarpani	—	1	—	1
22.	Mawadhar	—	1	—	1
23.	Patisain	—	—	—	—
24.	Mundneshwar	—	1	—	1
25.	Pipalipani	—	1	—	1
26.	Jakheti	—	1	—	1
27.	Agrora	—	—	1	1
28.	Paidul	1	—	—	1
29.	Parsundakhal	—	1	—	1
30.	Kandara	—	1	—	1

* People's movement patterns seeking functions of various orders of importance were mapped and were used as one of the criteria for selecting central villages, service centres and growth centres. Details can be seen in chapter IV of this report.

TABLE IX 2 : (*Contd.*)

1	2	3	4	5	6
31.	Bubakhal	—	—	—	—
32.	Daudadevi	—	—	—	—
33.	Pauri	2	4	1	7
34.	Kyark	—	1	—	1
35.	Kirtinagar	—	—	—	—
36.	Srinagar	1	2	1	4
37.	Sumari	—	1	1	2
38.	Chaubatiakhal	—	1	—	1
39.	Choprium	—	—	—	—
40.	Bhainswara	—	1	—	1
41.	Sikuphal	—	1	—	1
42.	Pokhrikhet	—	1	—	1
43.	Champeshwar	—	1	—	1
44.	Pabau	—	1	—	1
45.	Khirsu	—	2	—	2
46.	Bhattisera	—	1	—	1
47.	Kherakhal	—	2	—	2
48.	Mailisain	—	1	—	1
49.	Chifalghat	—	1	—	1
50.	Sankarsain	—	—	1	1
51.	Cholusain	—	1	—	1
52.	Bajwar	—	—	—	—
53.	Damdeval	—	1	—	1
54.	Chaunrikhal	—	—	—	—
55.	Pokhri	—	—	—	—
56.	Bhira	—	1	—	1
57.	Thailisain	—	2	—	2
58.	Nautha	—	1	—	1
59.	Chakisain	—	1	—	1
60.	Paithani	—	1	—	1
61.	Barsuri	—	1	1	2
62.	Rudraprayag	1	1	—	2
63.	Khankara	—	—	—	—
64.	Sumerpur	—	—	—	—
65.	Ratura	—	1	—	1
66.	Molkakhal	—	1	—	1
67.	Gidokhal	—	—	—	—
68.	Chaunra	—	1	—	1
69.	Gadoli	—	—	—	—
70.	Tarpali	—	1	—	1
71.	Bungidhar	—	2	—	2
72.	Samoya	—	1	—	1
	Total	8	60	8	76

The total number of flour mills required during 1979 and 1984 are estimated as 66 and 75, respectively. A flour mill of one ton per day capacity can be installed with an investment of Rs. 7,500 and it can be operated with a 5 H.P. electric motor.

Forest-based industries. The tehsil has a vast forest area which produces a large quantity of timber and some amount of resin. Currently, most of these raw materials are

sent outside the district. If forest-based industries are established in the study area, this vast raw material can be processed locally either in finished form or in part finished form to be sent out for further processing.

Paper, Newsprint and Pulp. Currently, there is an acute shortage of these products in the country. Whether the demand for paper, paper board and newsprint will increase even further will depend on the spread of education, rate of industrial growth and in the consequent improvement in the standard of living.

The all-India consumption of paper and newsprint during 1968-69 was 6.45 lakh tonnes and 1.7 lakh tonnes, respectively. The per capita consumption for the same period was 1.8 kgms. Assuming per capita demands of 4.0 and 6.0 kgs. for paper products during 1976 and 1981, the Planning Commission has estimated the total requirements of paper for these years.* These estimates can be seen in Table IX.3.

TABLE IX.3 : ESTIMATED DEMAND OF PAPER AND PAPER PRODUCTS

S.No.	Type	Estimated future demand (in '000 tonnes)	
		1975–76	1980–81
1.	Paper and paper board	2,000	3,000
2	Newsprint	450	600
3.	Commercial paper	400	600
	Total	2,850	4,200

Source : Study on forest raw materials for pulp, paper, newsprint by Committee on Natural Resources, Planning Commission, 1965.

It can be seen from the above table that the demand for paper and paper products during 1975-76 and 1980-81 will be 2.8 million tonnes and 4.2 million tonnes, respectively. Assuming an annual rate of increase of 10 per cent, the demand for paper and paper products will be about 5.5 million tonnes during 1984. As against this demand, the production up to 1969 was only 6.77 lakh tonnes. Eventhough statistics for the present production is not available, it is seen that there is acute shortage of these items in this country. A careful study will reveal that the main reason which is preventing a rapid growth of paper mills is the shortage of raw materials.

Raw material requirements of paper industry. The normal fibrous materials sued for paper industry are bamboo, coniferous (long fibre) wood and sabai grass. In addition, a large number of other materials such as waste paper, straw, wood pulp, bagasse are also used. The standard break-up of this components in percentages is shown in Table IX.4.

It can be seen from the Table IX.4 that about 67 per cent of the total raw material required comes from bamboo and coniferous wood. The location of paper mills should, therefore, be governed by the availability of these raw materials. As we have already seen, the study area has a rich reserve in coniferous trees and the possibility of establishing paper mills in the area needs to be seriously examined.

* Planning Commission, Government of India, *Revised Fourth Five Year Plan Proposals*, Forestry Sector, New Delhi, 1969.

TABLE IX.4 : PERCENTAGE OF RAW MATERIAL COMPONENTS IN PAPER INDUSTRY

S.No.	Raw material	Percentage
1.	Bamboo and coniferous wood	66.7
2.	Sabai grass	5.8
3.	Waste paper	3.3
4.	Straw and other material	0.8
5.	Imported wood pulp	2.5
6.	Indigenous wood pulp	12.5
7.	Bagasse	3.3
8	Salai wood	3.8
9.	Rags	1 3
	Total	100 0

Source : South-East Resource Region Development Plan—Joint Planning Board for S.E.R.R., New Delhi, 1971.

The Commission on Forest Resource Utilization has recommended establishment of 'Mini' paper mills with a capacity of 30-50 tonnes per day. The annual capacity of a mini-paper mill is 6,000 tons and the raw material requirement is about 12,000 tonnes per year.

Availability of raw materials for paper industry in the study area. It will be unrealistic if we assess the availability of raw material for a paper mill in the study area alone. As the requirements of the industry are heavy, we have assessed the potentiality of the entire district. The forests of Pauri tehsil are predominantly made up of Pine and Oak trees. The predominant forest trees in the remaining part of the district (Lansdowne tehsil) are Pine and Bamboo. Our earlier analysis shows that the production of coniferous timber in Pauri tehsil during 1979 and 1984 will be 6,050 tonnes and 8,075 tonnes, respectively.* From the forests of Lansdowne tehsil, the area of which is about 2 times the former, we can reasonably assume that at least an equal quantity of coniferous and bamboo wood will be available for the paper mill. The district can, therefore, very well meet the raw material requirements of a mini-paper mill.

Proposed paper mill and its location. On the basis of our evaluation of the availability of raw material in the district, a small paper mill with an initial capacity of 20 tonnes per day can be recommended for the year 1979. The capacity may be increased to 30 tonnes per day by 1984. We recommend Satpuli as the location for this plant. Satpuli has many advantages over other possible centres. The raw material required for this mill, mostly Pine timber, can be floated down the western and eastern Nayar rivers. These rivers are well connected with the Pine forest areas in the district. Satpuli is also on the main road connecting Kotdwara and Dogadda in Lansdowne tehsil and Pauri and Srinagar in Pauri tehsil. The road also connects Satpuli with centres outside the district. Geograhically, Satpuli has the most central location in the district. The water requirement of the mill 50,000 gallons for one tonne of finished paper, can be easily provided for as Satpuli is also located at the confluence of East and West Nayar rivers, both of which are perennial rivers.

Rosin and turpentine unit. Pine forests in the tehsil yield resin which is the raw material for the production of turpentine and rosin. While rosin is used in paper, soap and

* For details see chapter VII of this report. The figures given in cum. in chapter VII have been converted into tonnes by using a conversion factor of .576 tonnes per c.u.m. See, Khanna, P.N., *Indian Practical Civil Engineers' Handbook*, Engineers' Publishers, New Delhi, 1966.

paint industries, turpentine is a main component in varnish. At present there is acute shortage of rosin and turpentine in this country and consequently many industries which depend on these materials have reduced their production.

It is estimated that the yield of rosin in the study area during 1979 and 1984 will be 21,500 and 29,000 quintals, respectively. With the increase in production, the capacity of the existing Rosin and Turpentine Factory at Pauri can be increased to 10,000 quintals and the remaining quantity can be used to set up another unit at Thailisain which is surrounded by Pine forests.

Proposed saw mills. At present there is no saw mill in the tehsil. Timber sizes for building and packing cases are generally transported from Kotdwara. It is expected that an increased rate of industrialization, will also bring about an increased demand for packing cases. Construction of buildings particularly in the growth centres and service centres is also expected to increase. To meet this demand, saw mill in each growth centre is proposed. Each unit should have a capacity of sawing three tonnes of wood per day. Investment on machinery and equipment is estimated at Rs. 25,000 per unit.

Proposed units for wood-based furniture and utility articles. The study area has a large variety of hard wood such as Sal, Deodar and Fir which can be used in the manufacture of furniture and utility articles. The consumers of these items are educational institutions, government and private offices, hospitals, hostels and private individuals. The demand for these items which is currently met from units outside the district, will increase as many of the programmes recommended in this report are implemented.

Three units of furniture industry are, therefore, recommended one each at Pauri, Satpuli and Thailisain. An abundant supply of wood and wood waste (small cut pieces) from the proposed saw mills which can be used economically for furniture manufacture, will be available at these places. The local Government offices and educational institutions should patronise the proposed units and make their purchases from them as far as possible.

The initial investment in machinery and equipment is expected to be of the order of Rs. 40,000 and will provide employment to about 20 workers with a production of about Rs. 1 lakh per annum.

Proposed sericulture-based industries. In sericulture, activities connected with silk worm rearing are mainly agricultural in character. On the other hand, activities such as reeling of silk and silk weaving are removed from agriculture and are industrial in character. We have estimated earlier that the production of raw silk (both Mulberry and Tussar) in the tehsil, will be about 40 tonnes by 1979 and can be doubled by 1984. For the spinning and weaving of this silk a few industries can be set up in the tehsil.

Silk reeling industries. Reeling of silk is done either mechanically with the help of filature units or by traditional hand operated charkas. While the charka silk is used by the handloom weavers, the filature silk is often used for powerlooms. The quality of filature silk is always better than charka silk but the price is about double.

Since in the study area there is scope for both handloom and powerlooms, it is recommended that reeling should be done both by charkas and filature units. A hand-operated charka can produce 250 Kgs of silk threads in a year. Assuming that 50 per cent of the total production of silk will be done by charkas, about 80 charkas will be required by 1979. With the increase in production, the number of units can be increased to 160 by 1984. For processing the remaining silk, about 160 filature units will be required by 1979 and another 160

by 1984. These spinning units can be located in central villages and service centres in silk worm rearing areas.

Silk weaving. Silk weaving can be done by traditional handlooms, powerlooms or in the silk mills. Since silk mills require a very large quantity of silk, we do not recommend them for the next ten years. Weaving of silk in the teshil should, therefore, be done by handlooms and powerlooms until silk worm rearing can be undertaken on a very large scale in the tehsil.

Handlooms. The financial investment required for a silk handloom is very low as compared with powerlooms. A handloom unit can be established with an investment of Rs. 600. However, with improved accessories such as warping machine, standard reeds, dobbies, jaquarus, warping frames, etc. the investment may go up to Rs. 2,000. Each loom can consume at an average 25 Kgs of silk per month and the production will be about 200 metres of silk fabrics. The annual turnover will vary from Rs. 5,000-10,000 based on the number of hours of work per day. Each weaver should be a proprietor and additional labour can be provided by the family members. Only in rare cases, weavers will need to engage hired labour.

Assuming that 50 per cent of the silk produced in the tehsil will be used by handlooms, about 60 units will be required by 1979. The number can be doubled by 1984. The handloom industries can be located in those clusters where silkworm rearing has been proposed earlier.* It is also recommended that handloom silk weavers cooperatives should be formed and raw materials required by the weavers should be distributed through these cooperatives.

Powerlooms. Powerlooms can produce good quality silk but the investment will be comparatively higher. The initial investment varies from Rs. 5,000-10,000 depending on the accessories provided. Each powerloom may require, on an average, 500 Kgms of silk annually to produce about 4,000 metres of good quality silk fabrics. The raw material will be the silk spun in the filature units. Assuming that 50 per cent of the silk produced in the tehsil will be used by powerlooms, about 40 units will be required by 1979. With the increase in production, the number of units can be increased proportionally. It is recommended that the supply of raw material and sales of finished products should be undertaken by the weavers primary cooperatives.

Fruit-based industries. Development programmes in horticulture in the tehsil will succeed only if there is a well ensured market for the fruits produced. At present, a large quantity of fruits go waste as the export is limited to good quality fruits only. For want of adequate storage and preservation facilities, the fruits are disposed of at the harvesting season itself at a distress price. From our analysis of the potential for horticulture, it has been found that the study area is quite ideal for the cultivation of a large variety of fruits ranging from tropical fruits such as mango and guava to temperate fruits like apple and plum. There is, however, no hortculture-based industrial unit in the tehsil or in the neighbouring areas. There is a good demand for canned and preserved fruits from the defence forces stationed in the border areas in close proximity to the study area. At present, canned fruits such as jams, jellies, juices required by the defence forces are brought from the plains at a heavy cost. Apart from this, processed fruits will find market in all the chief urban centres in the country and the prospects for export is also bright. During 1972-73, the processed foods division of the U.P. Agro-Industries Corporation has exported mango juice worth Rs. 5.66 lakhs to Soviet

* See Chapter VII.

Russia.* It may also be noted that the Planning Commission has given approval for the establishment of 22 fruit processing units for the hill districts during the Fifth Five-year Plan.*

In the chapter on horticulture, we have estimated that the production of fruits during 1979 and 1984 will be 15,800 tonnes and 24,300 tonnes, respectively and after local consump-tion and export, the surplus will be at least 50 per cent of the production. This will be available for the fruit preservation industries. Taking into account the location of orchards, marketing, storage and other infrastructural facilities, the following centres have been chosen for the fruit processing industries.** The capacity of each unit is shown in Table IX.5.

TABLE IX 5 : LOCATION AND CAPACITY OF PROPOSED FRUIT PRESERVATION INDUSTRIES

S. No	Location	Per day capacity
1.	Pauri	5 tonnes
2	Srinagar	4 tonnes
3.	Khirsu	2 tonnes
4.	Satpuli	4 tonnes
5.	Kanskhet	2 tonnes
6.	Thailisain	5 tonnes
	Total	22 tonnes

The above units will have a total annual capacity of 6,600 tonnes during 1979. The capacity can be doubled by 1984. It is estimated that for a plant with 2 tonnes per day capacity, investment in machinery comes to Rs. 75,000 with employment potential of 22 persons. For a unit with 4 tons per day capacity investment in machinery works out to Rs. 3.50 lakhs with an employment potential of 70 persons. The investment includes a cold storage plant of Rs. 1.40 lakhs (150 tonne capacity).† The units can undertake canning and bottling of fruits, juices, squashes, jams, jellies, pickles and chutneys, etc. The establishment of fruit preservation industries will further generate employment in industries like containers (tin and glass) cartons, label packing cases, etc.

Dehydrated potato chips. About 50 per cent of the estimated production of potatoes will account for local consumption. With the remaining quantity available, one small-scale unit can be established for producing dehydrated potato chips. The prospective unit can be set up at Pauri in view of its importance as collection and distribution centre. The main outlet for potatoes are the institutional consumers in all the urban centres of the country and the defence personnel concentrated in and around Pauri tehsil. The proposed plant will have a capacity of 2 tonnes per day and the total number of working days in an year will be 150 as potatoes are seasonal.

* Summary of speech by Sri M.S. Haq, Chairman, U.P. State Agro-Industrial Corporation at the Sixth Annual General Meeting, Lucknow, 1973.

** For example, it is estimated that for the processing of 1 tonne of fruits, 300 gallons of water is required. The sites for fruit-based industries will naturally depend on the availability of enough water. The same considerations have been taken into account in respect of other infrastructural requirements.

† Nagaiya, D., *et al.*, ***Industrial Potential of Darjeeling District***, S.I.E.T. Institute, Hyderabad, 1972.

Pasteurisation and milk products plant. We have estimated in chapter VIII that a minimum of 20,000 litres of milk can be collected from the proposed milk shed area in Pauri tehsil and an equal quantity from Lansdowne tehsil. Satpuli is the most ideal location for this dairy project owing to its proximity to the milk shed area and its central location in the district. The other infrastructure requirements such as water, power, suitable land are also readily available in this centre. The proposed dairy at Satpuli will have an initial capacity of 40,000 litres and it will be raised to 60,000 litres by 1984. In addition to pasteurisation of milk, processing of other products such as milk powder, condensed milk, butter-milk, ghee and butter can be produced in this project. At present, there is acute shortage of these products in the tehsil and in the district. The proposed plant can certainly mitigate the shortage in the area.

The Satpuli plant is proposed to have two sections, one for the pasteurisation of liquid milk and the other for milk products. The capacity of chilling and pasteurisation plant should be 400 litres per hour expandable to 600 litres per hour by 1984. The capacity of other plants for the production of milk powder, butter, ghee, etc. will be determined by the amount of surplus milk available.

The pasteurised milk has to be bottled and will be carried in refrigerated milk vans. It is expected that half the quantity of refrigerated milk will be sold in the urban centres north and south of Satpuli namely, Pauri, Srinagar, Rudraprayag, Bahbazar, Lansdowne and Kotdwara and in the defence establishments in the area. The total investment on this project is estimated as Rs. 30 lakhs.

Wool-based industries. Sheep rearing in the tehsil can be improved only if there is a well ensured market for the wool produced. The estimated production of wool during 1979 and 1984 in the 22 clusters where commercialised sheep rearing is proposed, will be about 63,000 Kgs, and 1,26,000 Kgs, respectively. The wool produced is also proposed to be collected in the processing centres at Prasundakhal and Thailisain. The wool thus collected can be used for manufacturing a large number of woollen goods such as rugs, blankets, carpets, coatings, etc.

Woollen handloom industries. Already there are a few handlooms in the tehsil making coarse woollen blankets and 'kamblis'. Most of these units are cottage industries making use of domestic labour. The main hindrance in the development of this sector is the lack of finance. With the formation of the sheep rearers and wool weavers primary cooperatives in each of the central villages where sheep rearing is proposed, the problem of finance can be solved. It is proposed that at least 25 per cent of the wool collected by the cooperatives should be distributed to the woollen handloom weavers. To install a handloom unit, a fixed capital of Rs. 200 will be required. The raw material requirement per annum will be about 500 kgms. At the rate of 25 per cent of the production of wool for cottage industries, the number of handloom industries that can be set up during 1979 will be 30 and this can be increased to 60 by 1984.

Woollen textile mill. The woollen goods manufactured by handlooms will be of coarse quality as the raw material used is also mostly coarse wool. This product will have only local market. The tehsil is best suited for the rearing of fine wool sheep and we have recommended that the maximum number of sheep reared should be of fine wool type. The fine wool products will have a fairly good market both inside and outside the country. We have estimated that the wool collected at the centres Parsundakhal and Thailisain during 1979 and 1984 will be 63,000 and 1,26,000 Kgms. Making a deduction of 25 per cent for

handloom industries, the remaining quantity will be about 50,000 Kgms during 1979 and 1 lakh Kgms during 1984. A woollen textile mill can, therefore, be established with an annual initial capacity of 50 tonnes. The capacity can be doubled during 1984. The mill can produce about 1.25 lakh metres of woollen fabrics at the beginning and the production can be increased gradually. The mill is proposed to be established at Thailisain under the management of the proposed District Union of Sheep Rearers and the Weavers' Cooperative Society. Since a large number of sheep can be reared in the areas surrounding Thailisain and it being a growth centre, the location is justified The mill can be started by 1979 with 100 looms and 500 spindles. The capital investment will be about 10 lakhs.

Meat processing unit. In the chapter on animal husbandry we have recommended that 25 per cent of the sheep reared should be of the mutton type and the remaining of the woolly type. Taking into account the number of sheep proposed to be reared, the production of meat is estimated as 70 tonnes and 140 tonnes during 1979 and 1984. Out of this it can be assumed that 50 per cent of the production will be consumed in the urban areas and in other potential growth centres. The remaining quantity can be used for processing and canning. It is proposed that a meat processing unit should be established in the tehsil with an annual capacity of 35 tonnes. The capacity can be doubled by 1984.

This unit can be located at Parsundakhal which is already proposed as a centre for collection and distribution of wool. As in the case of preserved fruits, defence forces stationed in the borders will be the bulk consumers of these products. In addition, it can be anticipated that there will be a good demand from the urban centres.

Leather tanning. Leather tanning at present is carried out by the artisan class in different parts of the tehsil. There is no organised tannery in the study area eventhough sufficient quantities of hides and skins are available to set up an organised tannery unit. It is estimated that 28,800 hides and 50,000 sheep and goat skins can be collected annually with the present number of livestock population. Assuming an average weight of 20 Kgs for hides and 2 Kgs for skins, the total production will be about 700 tonnes. On the basis of the intensive animal husbandry programme recommended in this report, it can be assumed that the production will be more in future.

For better utilization of hides and skins and to retain, roll and process the products of village tanners, two small units of tannery with an initial capacity of 1 tonne per day in each is proposed. These units can be located at Thailisain and Parsundakhal where other live-stock-based industries are also proposed. The investment for each unit will be about Rs. 1 lakh and it will provide employment to about 50 persons.

Bonemeal industries. Animal bones contain 22 to 24 per cent of P_2O_5 in the crushed form which could be utilized for fertilizers. Assuming an 8 per cent death rate of cattle and recovery of 20 Kgms of bones per carcass it is estimated that even at present, about 600 tonnes of bones will be available in the tehsil. But presently there is no proper agency for the collection of carcasses and bones and many of the dead animals often go unutilized.

Keeping the rising demand of inorganic fertilizers and the availability of large quantities of bones in the tehsil, it is proposed to install a unit of bone meal factory with an annual capacity of 300 tonnes. This unit can be located at Thailisain. The investment will be about Rs. 40,000 of which Rs. 20,000 will go in fixed investment. Such a unit will provide employment to 10 persons.

CHAPTER X

PLANNING FOR SOCIAL FACILITIES

The degree of development of an area and the social facilities available in it are very closely related. Backward areas with poor social facilities, suffer from an additional handicap. The very absence of educational, health and recreational facilities inhibits development by discouraging qualified people to come and settle down in these areas. Pauri, for example, not only fails to attract qualified doctors, teachers and other professionals but actually sends out people to other parts of the country looking for jobs. The only professionals now working in the area are government officials who would, perhaps, prefer to be elsewhere, where educational and health facilities for their families are better.

The need for providing social amenities in backward areas has been recognized in the constitution and operational guidelines for providing these facilities have been laid down in the Fifth Five-year Plan in the form of a Minimum Needs Programme. Any plans for introducing social facilities in an area must, however, treat social facilities as a part of the overall productive process. If treated purely as a welfare measure, social facilities will remain as a constant liability of the government and during financial uncertainties in the country, may be the first programme to be drastically reduced or even withdrawn.

We have viewed social facilities as a part of the total development of the study area and feel that the programme proposed in this chapter for improving and expanding available facilities is as important as any other programme recommended in this report. The reasons for adopting this viewpoint should be obvious but a few important ones may be listed here. First, the development of agriculture, horticulture, forestry, sericulture and industries will require skilled manpower from the area. The state of health of the working force is also directly related to the level of production and the degree of efficiency of the workers. Secondly, local and outside talents are always a scarce resource and have to be provided with at least a minimum set of amenities such as good schooling and health facilities. Thirdly, the new facilities will open up new employment opportunities for the local people.

In the Fifth Five-year Plan, the Planning Commission has suggested a few standards for the implementation of its Minimum Needs Programme. These standards are a good starting point for the preparation of a plan for social facilities in the study area. The Minimum Needs Programme of the Planning Commission includes the following items :*

Education. As regards elementary education, it should be possible to provide in the Fifth Plan 100 per cent facilities for children of the 6-11 age-group and 60 per cent for the age-group 11-14. In geographical terms, the objective should be a primary school within 1.5 kilometres and a middle school within 5 kilometres of a village.

Health facilties. The present standard of one public health centre for a block population of 80,000—1,00,000 supported by 8 to 10 sub-centres, each serving a population of 10,000 has to be followed. However, the coverage of a sub-centre will have to be reduced to a population of 4,000-5,000 in the future.

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* Planning Commission, Government of India, *Towards Self-Reliance : Approach Paper to the Fifth Five Year Plan*, Government of India Publication, New Delhi, 1972.

Drinking water. It has been estimated that about 1,50,000 villages out of a total of 5,67,000 villages suffer from either water scarcity or salinity of water. On this, the approach document says "In order to meet this basic minimum need by the end of Fifth Plan, it may be necessary to step up expenditure to an average of Rs. 100 to 120 crores per annum."

Rural roads. So far as roads in rural areas are concerned, it is necessary to aim at providing all-weather roads by the end of the Fifth Plan to all villages above a minimum population size say 1,500 people. In hill areas or coastal areas where the population is relatively more dispersed, it will be necessary to provide all-weather link roads to a cluster of villages having a population above a minimum size.

Rural electrification. By the end of the Fifth Plan, at least 30-40 per cent of the rural population in all states will have electricity.

In addition, housing for the landless rural labour and creation of employment opportunities have also been included in the minimum needs programme.

The above standards are for the country as a whole and need modification as they are applied to specific areas with a unique set of geographical, economic and social characteristics. As transportation, power and water supply have been dealt with separately in this report, this chapter will be devoted to an analysis of the existing educational and health facilities and to the formulation of a proposed programme for removing existing gaps and for establishing new facilities wherever warranted for an overall development of the study area.

Evaluation of existing educational facilities. The existing educational situation in Pauri tehsil can be understood from the Table X.1.

TABLE X.1 : EDUCATIONAL FACILITIES IN PAURI TEHSIL—1973

S. No.	Standards	Classes	Age-group	No. of schools/ colleges	Students enrolled*
1.	Primary School	I to V	6—10	397	31,760
2.	Junior High Schools	VI to VIII	11—13	56	3,920
3.	High Schools	VI to X	11—15	12	2,395
4.	Junior Colleges	VI to XII	11—17	12	5,314
5.	Degree Colleges	—	Above 17	1	429
6.	Post Graduate College	—	Above 17	1	
	Total			479	43,818

* Number of students in the primary and middle schools are estimates based on the primary survey conducted in 81 schools in the tehsil.

At present there are 397 primary schools, 56 junior high schools and 12 high schools in Pauri tehsil. In addition, there are 12 junior colleges and two degree colleges. The latter provides educational facilities for post graduate students also. Except high schools and junior colleges, the pattern of educational institutions is the same as in other parts of the country. High schools offer education from VI to X standards and the junior colleges carry separate sections for middle school (VI to VIII)) high school (IX and X) and intermediate

classes (XI and XII). Thus the prevailing educational system provides facilities for children finishing primary schools to directly enrol in high schools or junior colleges as well as in junior high schools.

Another feature of the educational system in the tehsil is that children start their education about a year late. Here children start primary school at the age of six whereas in other areas, particularly in the plains, schooling starts at the age of five. This late admission in primary schools is attributed to the distant location of schools far away from their homes.

Extent of education. In order to assess the extent of education in the tehsil, the number of children in different age groups in 1973 was estimated. As age-wise composition of population recorded in the 1971 census was not available at the time of writing this report, the proportion of children under different age groups in the rural areas of Garhwal district published in the 1961 census was used. It was assumed that the overall variation in the proportions in 1961 and 1973 will be only very marginal. This seems to be justified as there was no appreciable rise in the birth rate and age specific death rates between 1961 and 1971 according to the bulletins issued by the Registrar General.

The estimated population for each cluster during 1973 and the number of children in the age group 6-10, 11-13, 14-15 and 16-17 are shown in Appendix X 2.

The actual enrolment of students in different classes was collected during our primary survey in 1973. A comparison of the number of children in the school-going age group and their actual enrolment is shown in Table X.2.

TABLE X.2 : SCHOOL AGE POPULATION AND ENROLMENT IN SCHOOLS IN PAURI TEHSIL—1973

S. No.	Classes	Age-group	School age population	Percentage of school age population to total population	Actual enrolment	Percentage of enrolled students to population in school going age
1.	I—V	6—10	35,225	16.4	31,760	90.02
2.	VI—VIII	11—13	15,015	7.2	8,005	53.31
3.	IX—X	14—15	7,701	3.7	2,877	37.43
4.	XI—XII	16—17	6,296	3.2	747	11.89
5.	I—XII	—	64,237	31.2	43,389	67.5

It can be seen from the above table that the school-going children up to junior college was 43,389 constituting 67.5 per cent of the estimated population in the school-going age group. The percentage of attendance in the primary school was 90.02. The corresponding figures for junior high schools and high schools were 53.31 and 37.43, respectively. In the junior colleges, the percentage of attendance was as low as 11.89.

Size of schools and population served. In Pauri tehsil where the settlements are separated from each other by a difficult terrain, the number of schools with reference to population will have to be more than that in the plains. But the existing picture is quite different as can be seen from the Table X.3.

TABLE X.3 : SIZE OF SCHOOLS AND POPULATION SERVED, PAURI TEHSIL—1973

S. No	Standards	Average number of students	Average class size	Average population served by each unit
1.	Primary School	80	16	510
2.	Junior High School	70	23	2,600
3.	High School	220	44	8,800
4.	Junior College	440	63	17,000

A comparison of Table X.3 with the general norms suggested by the Institute of Town and Country Planners (Table X 4) for the rural areas will provide a perspective for evaluating the adequacy or existing facilities in the tehsil.

TABLE X 4 : NORMS FOR ELEMENTARY EDUCATION IN RURAL AREAS

S. No.	School section	Classes	No. of students per school	Population to be served by each school
1.	Primary School	I to V	75	500
2.	Middle School Secondary	VI to VIII	90	1,500
3.	Higher Secondary School	IX to XI	120	2,000

Source : Institute of Town and Country Planners, New Delhi.

A comparison of Tables X.3 and X.4 shows that although primary schools in the tehsil fare well in terms of enrolment and population served, junior high schools and high schools fall below the norms. At the cluster level even the primary schools fall short of the norms (Appendix X.3).

Educational trend. In order to ascertain the stage at which children discontinue their studies and to assess the probable number of students failing in each class, we compiled data on the number of students studying in different classes during 1971-72 and 1972-73. Since this particular data were not available for the tehsil, district-level data were used. The estimation of failing or dropping out was made by comparing the number of students enrolled in two consecutive standards in two consecutive years. For example, students studying in the second standard in 1972-73 will be the same students who were in the first standard during 1971-72. The difference between these two figures, if negative, will give the number of students dropped in the first standard in 1971-72. This includes those who failed and

those who discontinued their studies in the first standard. Thus comparing the number of students in each class in 1972-73 with the number of students in the preceding class in 1971-72, the number of students who dropped out in each class was calculated (Table X.5).

TABLE X.5 : PERCENTAGE OF STUDENTS DROPPED IN EACH CLASS

Class	Number of students 1971-72	Number of students 1972-73	Number of students dropped	Number of students dropped as percentage of students in the class
I	25,487	—	5,092	19 92
II	20,153	20,395	3,904	19 38
III	16,057	16,249	2,497	15 56
IV	13,413	13,560	1,202	8 97
V	12,076	12,211	4,131	34.21
VI	7,861	7,945	836	10 64
VII	6,957	7,025	613	8.82
VIII	6,282	6,344	2,100	33.43
IX	4,085	4,182	357	8.74
X	3,679	3,728	2,651	72.06
XI	1,017	1,028	—	—
XII	1,017	1,028	—	—

The above table reveals that the percentage of students dropped in Class V, VIII and X are high compared with other classes. While the percentage of students dropped in Class V and VIII were 34.21 and 33.43, respectively, this figure was 72.06 in the Xth standard. This phenomenon cannot be due to the high rate of failure in the above classes as by and large the percentage of failure will be same in all the classes. So it can be reasonably assumed that children in the above classes which are the final classes in the primary, junior high school and high school sections discontinue their studies. This is mainly attributed to the lack of educational facilities at the higher levels within reasonable walking distances. This further necessitates the need for identifying areas where educational facilities are deficient. This is attempted in the following paragraphs.

Access to schools. The study area is not only deficient in the number of educational institutions of different orders but the spatial distribution of these institutions is also far from satisfactory. Although these facilities appear to be well distributed there are settlements which do not have easy access even to a primary school. This problem exists in most of the clusters. In Bungidhar cluster there are settlements which do not have a primary school even within 5 kilometres. Similarly, in Samoya cluster, to avail the facility of a junior high school, one has to walk down 10 Kms. In case of high school the distance is even more. When this is compared with the planning commission's access standards of 1.5 Km for a primary school and less than 5 Km for a midde school the existing gap in the location of these facilities becomes more clear.

Teachers and Classrooms. The quality of an educational facility can be judged by taking the number of teachers and classrooms per school. The average number of teachers and classıooms for the cehsil are given in the following Table X.6.

TABLE X.6: TEACHER AND CLASSROOM RATIO IN PAURI TEHSIL–1973

S No.	Standard	No. of teachers per school	No. of teachers per class	No. of class-rooms per school	Rooms per class
1.	Primary School	2 3	0.46	3.0	0.6
2.	Junior High School	4 0	1.3	3.0	1.00
3.	High School	9.4	1.88	5.3	1.06
4.	Junior College	23.3	3 33	10.7	1.53

The above table shows that the average number of teachers in the primary schools of the tehsil is only 2.3 whereas the number of classes are 5 (I-V). It means that one teacher is managing more than one class at a time. Taking the minimum requirement of one teacher per class, the deficiency of teachers in primary school level comes to 50 per cent. As regards classrooms, a primary school needs at least 5 rooms for the 5 classes. The average number of classrooms per primary school in the teshil is only 2.8. It indicates that there is a shortfall of rooms by 40 per cent. Junior High schools, High schools and Inter colleges appear to be in a better position with respect to number of teachers and classrooms.

Plan for educational facilities. From the foregoing discussion, it is clear that educational facilities in the tehsil are not satisfactory in terms of quantity,quality or spatial distribution. This calls for appropriate location of additional facilities and for the improvement in the existing ones. Proposals for additional facilities have to be made for filling existing gaps and for the future increase in the size of school-going population and their expected enrolment during the plan period. The size of schools and their spatial distribution have again to be decided on the basis of certain norms suitable for the geographical and socio-economic characteristics of the tehsil.

Estimation of school-going children in 1979 *and* 1984 *and the anticipated enrolment.* To estimate the size of school-going population in 1979 and 1984 in different age groups, their proportion to total population during 1973 was used. The cluster-wise population in 1979 and 1984* and the number of children in the age-group 6-10, 11-13, 14-15 and 16-17 are shown in appendix X.4 and X.5.

In order to estimate the probable enrolment in primary schools, it is assumed that the percentage of attendance in the primary school will be increased from the present 90.02 to 95 by 1979 and 100 by 1984. Thus the Planning Commission's target of 100 per cent enrolment of students in primary school age groups will be achieved by 1984. The anticipated enrolment of students in the primary schools at the above rates will be 35,920 and 40,450 during 1979 and 1984, respectively.

The number of children going to middle school in 1979 and 1984 will be from those students studying in the first three standards in 1973 and 1979, respectively. Our earlier analysis (Table X.5) based on primary data shows that only one-third of the children in

* For a detailed description on the method of population projection see appendix X.1

the first three standards will reach middle school classes after five years. The remaining is accounted for by students who fail in different classes and those who discontinue their studies. However, it can be expected that the prevailing good tempo for higher education and the improvement of schooling facilities will reduce the number of students dropping in each class. We assume, therefore, that the percentage of children going from primary to middle school section will be increased from 33 per cent in 1971 to 40 per cent in 1979 and 45 per cent in 1984. Thus the children in the middle school classes during 1979 and 1984 are estimated as 8,964 and 11,344 constituting 55.61 per cent and 65.78 per cent of the children in the age-group 11-13.

The children enrolled in high schools during 1979 and 1984 will be constituted by those children who are studying in standards IV and V in primary schools in 1973 and 1979, respectively. At present only 30 per cent of the children studying in these classes reaches high school. Assuming a decrease of 5 per cent in 1979 and 10 per cent in 1984 in the number of children both failing and discontinuing studies, the total number of children in the high school classes during 1979 and 1984 will be 3,390 and 4,380 constituting 41.28 per cent and 49.41 per cent of the children in the age-group 14 and 15.

The junior college students in 1979 and 1984 will be those who are studying in VI and VII standards in 1973 and 1979, respectively. Assuming a similar improvement in the percentage of children going for higher education as in the case of middle school and high school classes, the number of students in junior colleges (XI and XII class) during 1979 and 1984 will be 1,170 and 1,570, respectively. The estimated school-going population and enrolment for 1979 and 1984 are shown in Table X.7.

TABLE X.7: ESTIMATED SCHOOL-GOING POPULATION AND ENROLMENT FOR 1979 AND 1984

S. No.	Class	1977			1984		
		Estimated School-going Population	Anticipated enrolment	Enrolment as percentage to school-going population	Estimated School-going Population	Anticipated enrolment	Enrolment as percentage of school-going population
1.	I to V	37,806	35,920	95	40,450	40,450	100
2.	VI to VIII	16,119	8,964	55.61	17,243	11,344	65.78
3.	IX to X	8,210	3,390	41.28	8,862	4,380	49.41
4.	XI to XII	6,714	1,170	17.44	7,250	1,570	21.65

Access standards. Access standards for the location of primary, junior and high schools have been decided taking into consideration the age of the school-going children at different standards and the maximum distance they can cover without much difficulty. In the tehsil, the children start going to a primary school generally at the age of 6 years. It is assumed that 1.5 Km is the maximum distance which a 6-year old child can walk down without

much difficulty. The distance of a primary school not, therefore, exceed 1.5 Km from any settlement. The minimum age at which the students join a junior high school is 11 years. The maximum distance of a junior high school from any settlement should not exceed 3 Km to make it convenient for this age children to go to school. For high school facilities the maximum distance of 5 Km seems to be reasonable.

Population standard. Both total population and the population of school-age children were considered to formulate this norm. Since in the study area the settlements are very small in size, it is recommended to have a primary school in all the settlements having a population of 400 and above. For a settlement of this population at the present proportion, children in the primary school age group will be more than 70 The other settlements which fall below this threshold population have been clubbed together and for every 500-700 population one primary school is proposed. In the case of isolated villages for which accessibility is the overriding criteria, one primary school can be located for a population of even 200. For this size of population, the school-going children will be 35 which is more than the minimum* prescribed for a primary school in the district.

As regards the junior high schools, there can be one school for every 1,500 population. The number of children in this school-going age group will be 105 and the number of students who will be enrolled at the rate of 55.61 per cent (Table X.7) will be about 60. Thus there will be a minimum of 20 students in each class.

The school-going population in the high school age-group (14 and 15) is estimated as 4 per cent of the total population. Thus for a population of 4,500 there will be 180 students in the high school age-group. At the estimated rate of enrolment of 41.28 per cent for 1979, the number of students enrolled in IXth and Xth class will be 75 for the above population. In addition, it can be anticipated that another 75 children will be enrolled in the middle school section. Thus the total strength of a high school will be 150 students. Hence, at an average, there will be 2 junior high schools and one high school for a population of 4,500.

The population requirement of a junior college has been judged by taking the percentage of children in the age-group 16-17. It is estimated that about 3.2 per cent of the population in the tehsil fall under this age group. Thus for every 10,000 population the number of children in the above age group will be 320. It is estimated that by 1979 the enrolment of students in the junior colleges will be 17.44 and thus for a population of 10,000 the enrolment in standard XI and XII will be about 60 students. It can also be assumed that about 150 students will also get enrolled in the junior high school and high school sections of the junior colleges. Thus the total strength of junior college will be 210.

Location of New Schools: Policies. On the basis of the norms mentioned above the following decisions have been tahen for the location of new schools of different orders.

Primary Schools. (*a*) All settlements having a population of 400 and above will have a primary school, (*b*) For a cluster of villages having a population of 500-700 there will be a primary school, (*c*) The primary school recommended for a cluster of villages having 500-700 will be located in the settlement having the highest population in that group or the settlement which has better linkage with the surrounding settlements, (*d*) All settlements will have a primary school within a walkable distance of 1.5 Kms, (*e*) In case a settlement

* The minimum number of students prescribed for the district by the District Inspector of Schools, Pauri is 30 for Primary School, 60 for Middle School, 150 for High School and 200 for Junior College.

is isolated and has at least 200 persons a primary school has to be located in that settlement, and (*f*) Existing primary schools will be retained irrespective of the rationality of its locations.

Junior High Schools. (*a*) All settlements will have a Junior High School* within a distance of 3 Kms, (*b*) For every 1,500 population one Junior High School will be the standard, however in exceptional cases for a few settlements having 1,000 population one school can be located, (*c*) When one school is located for a cluster of villages as far as possible it should be located in the central villages, and (*d*) A few Junior High Schools will be upgraded, however, the existing location of Junior High Schools will not be disturbed.

High Schools. (*a*) The distance between one high school and another and between a high school and a junior college should in no case exceed 10 Kms. Thus children of all settlements will have educational facility in high school classes within 5 Kms, (*b*) For a minimum population of 4,500 there will be one high school, (*c*) Whenever needed the Junior High Schools will be upgraded to high schools, (*d*) The high schools, proposed for a group of first-level clusters will preferably be located in the service centres, and (*e*) The location of Inter colleges will also be taken into account in deciding the location of high schools as the former also provide high school section.

Junior Colleges. (*a*) For every 10,000 population there will be a junior college, (*b*) All growth centres will have junior colleges, (*c*) Next priority in the location of junior colleges will be given to service centres, and (*d*) In order to make a balanced distribution of junior colleges it will be located in central villages also at appropriate locations.

Methodoogy. Existing primary, junior high school, high school and junior colleges were marked on a map showing all the settlements. The projected population of these settlements for 1979 and 1984 were also noted down. All types of roads, briddle paths and footpaths connecting different settlements were also included in the map. On the basis of the projected population and the accessibility standards, schools were then located for the year 1979 and 1984† (Table X.8). The schools located were then checked up with the cluster-wise anticipated enrolment of students under different age groups and estimated the requirement of classrooms and teachers. The location of proposed schools designated by the name of villages is shown in Appendices X.5, X.6, X.7 and X.8.

The estimation of classrooms and teachers for the primary schools have been made on the basis of the minimum requirement of one classroom and one teacher for each class. In the case of Junior high schools, High schools and Junior colleges the existing average figure for the tehsil is comparatively better. The average for the tehsil has, therefore, been taken as the norm for 1777 and 1984. This will improve the facilities in those cluster which fall below the average and will provide a uniform standard in the new schools.

Health and Medical Services. There are six levels of health and medical facilities in the tehsil. The lowest level units are the maternity and child health centres (MCH) and family planning centres (F.P.). Other units in the ascending order are the sub-centres,

* For the Junior High School section, the educational facilities provided by High School and Inter College has to be taken into account.

† The phasing of investment should be done in such a way as to construct the maximum possible number of schools during 1974-79 taking into account the requirement and to improve the facilities during 1979-84.

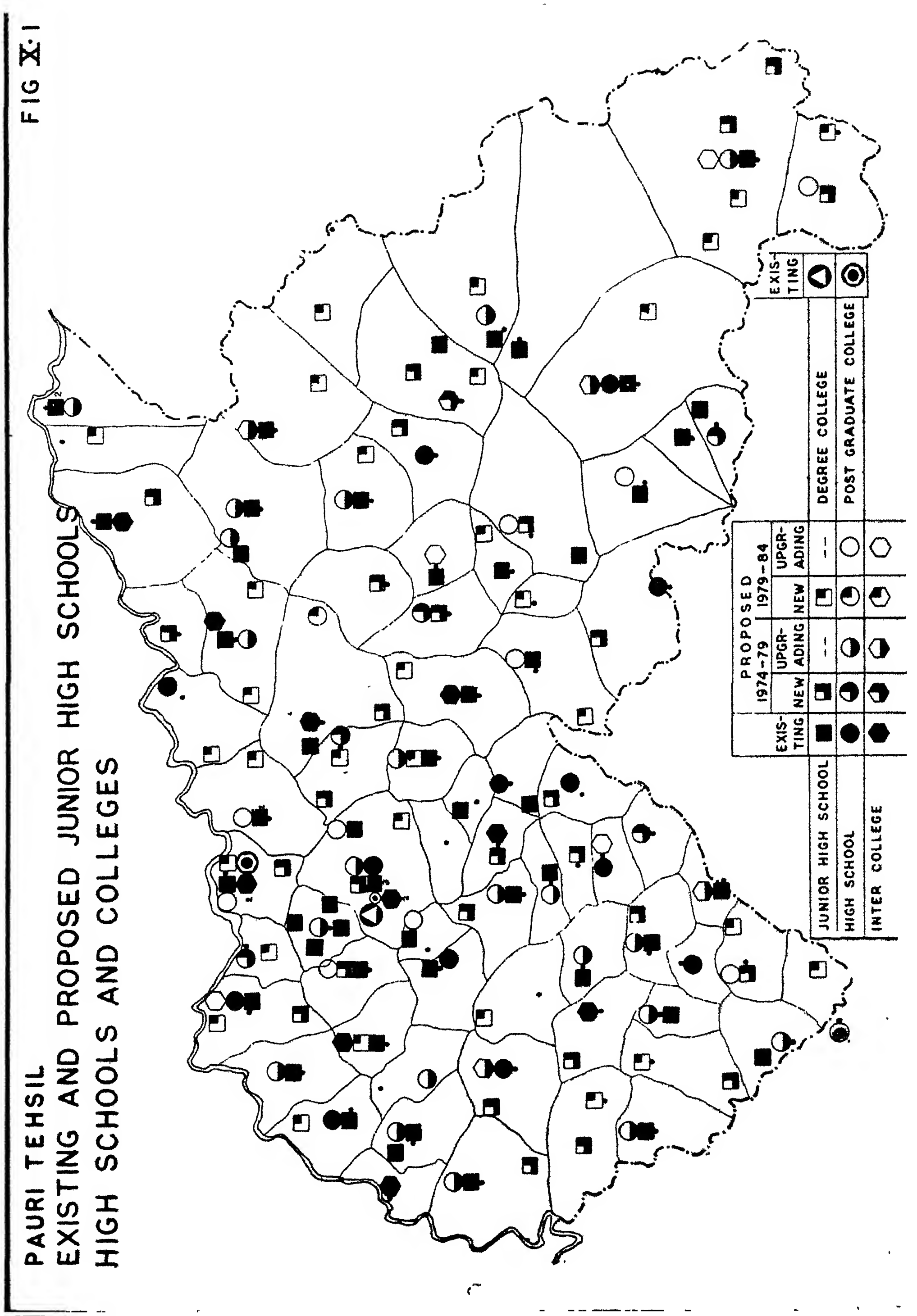
FIG X·1
PAURI TEHSIL
EXISTING AND PROPOSED JUNIOR HIGH SCHOOLS
HIGH SCHOOLS AND COLLEGES
EXIS-TING
PROPOSED
1974-79
1979-84
NEW
UPGR-ADING
JUNIOR HIGH SCHOOL
HIGH SCHOOL
INTER COLLEGE
DEGREE COLLEGE
POST GRADUATE COLLEGE

TABLE X.8: EDUCATIONAL REQUIREMENTS IN PAURI TEHSIL 1979-1984

Type of School	Year	No. of schools	No. of teachers	No. of classrooms
Primary School	1979	430	2,150	2,150
	1984	455	2,275	2,275
Junior High School	1979	68	272	204
	1984	84	336	252
High School	1979	36	340	190
	1984	45	425	240
Inter Colleges	1979	18	420	190
	1984	22	510	235

dispensary, public health centre, urban hospitals and the district hospitals. Out of these six categories, services of doctors are available only from the dispensary level. The other centres are under the charge of public health nurses and midwives. In this study, we assess the adequacy of these institutions in the above two distinct categories and proposals have been made to improve the facilities where deficiency is noticed.

The centres, where the services of a doctor are not available, are the MCH centres, F.P. centres and the sub-centres. In the sub-centres both the services of a MCH centre and the F.P. unit are available. During our primary survey in 1973, there were 17 MCH centres, P F.P. units and 11 sub-centres in the tehsil. Out of these units 10 MCH, 2 F.P. units and 9 sub-centres were located in the central villages and others were in dependent villages (Table X.9).

TABLE X.9 : MCH, FAMILY PLANNING UNITS AND SUB-CENTRES IN PAURI TEHSIL, 1973:

S. No.	Name of the Cluster	M.C.H. In central village	M.C.H. In other settlements	Family Planning In central village	Family Planning In other settlements	Sub-Centres In Central village	Sub-Centres In Other settlements
1	2	3	4	5	6	7	8
1.	Ghindwara	—	—	1	—	—	—
2.	Baganikhal	—	1	—	—	—	—
3.	Diusi	—	—	—	1	—	—
4.	Ghandiyal	—	—	—	—	—	1
5.	Safdarkhal	1	—	—	1	—	1
6.	Jamlakhal	—	—	1	—	—	—

TABLE X 8 : (*Contd.*)

1	2	3	4	5	6	7	8
7.	Delchaunri	1	1	—	—	—	—
8.	Kot	1	—	—	—	—	—
9.	Lwali	—	—	—	—	1	—
10.	Kaljikhal	—	—	—	—	1	—
11.	Parsundakhal	1	—	—	—	—	—
12.	Agrora	—	—	—	—	1	—
13.	Kyark	—	—	—	—	—	1
14.	Pauri	1	—	—	1	—	1
15.	Chaubatiakhal	—	—	—	—	—	1
16.	Srinagar	1	—	—	—	—	—
17.	Sikukhal	—	—	—	1	—	—
18.	Pokrikhet	1	—	—	—	—	—
19.	Pabau	—	1	—	—	1	—
20.	Khirsu	—	—	—	—	1	—
21.	Bhattisera	—	—	—	1	—	—
22.	Kherakhal	—	1	—	1	—	—
23.	Thailisain	—	1	—	—	—	—
24.	Damdeval	—	1	—	—	—	—
25.	Nautha	—	—	—	1	—	—
26.	Paithani	1	—	—	—	—	—
27.	Rudraprayag	1	—	—	—	—	—
28.	Ratura	—	—	—	—	1	—
29.	Bungidhar	1	1	—	—	—	—
	Total	10	7	2	7	6	5

* Maternity and child health centres and family planning units have been considered as institutions in the same level.

The categories where services of qualified doctors are available are the dispensaries, primary health centres and the hospitals. In 1973 there were 3 hospitals, 6 primary health centres and 6 dispensaries. The hospitals were located at Pauri, Srinagar and Rudraprayag. Out of these three units, the hospital at Pauri was the District hospital catering to the needs of whole district. The other two hospitals are uban hospitals limiting their service area in the respective centres. The locations of these institutions and facilities are shown in Table X.10.

TABLE X.10 : HEALTH AND MEDICAL FACILITIES IN PAURI TEHSIL 1973

S. No.	Name of the Central Place	Hospital		P.H.C.	Dispensaries	Doctors	Beds	Nurses
		District	Urban					
1	2	3	4	5	6	7	8	9
1.	Pauri	1*	—	—	—	6	83	8
2.	Srinagar	—	1*	—	—	2	38	3
3.	Rudraprayag	—	1	—	—	1	10	—
4.	Parsundakhal	—	—	1	—	1	4	—
5.	Gandiyal	—	—	1	—	1	4	—
6.	Khirsu	—	—	1		1	4	—
7.	Pabau	—	—	1		1	4	—
8.	Thailisain	—	—	1		1	4	—
9.	Satpuli	—	—	1		1	4	—
10.	Adhwani	—	—	—		1	4	—
11.	Kherakhal	—	—	—		1	4	—
12.	Chifalghat	—	—	—		1	4	—
13.	Chakisain	—	—	—		1	4	—
14.	Banghat	—	—	—		1	4	—
15.	Patisain	—	—	—		1	4	—
	Total	1	2	6	6	21	177	11

* There are separate hospitals for males and females in each case.

While the number of beds in each dispensary was 4, the hospital bed strength ranged from 10 to 83. Except in the hospitals at Pauri and Srinagar, the services of nurses were not available.

Health facilities and service population. The adequacy and inadequacy of the existing medical facilities can be judged by relating it to the service population. For calculating medical facilities and population ratio the total number of units operating at the level as well as other units which are at the higher levels were taken into account. This was necessary as the higher order institutions serve the facilities that will be available in an institution which is at the lower level. The Table X. 11 gives the average population served by each medical units.

TABLE X.11 POPULATION SERVED BY MEDICAL UNITS—PAURI TEHSIL, 1973

S. No.	Medical Unit	Population served
1.	M.C.H.	6,000
2.	Sub-Centre	11,000
3.	Dispensary	14,000
4.	P.H.C.	23,000
5.	Urban Hospital	70,000
6.	District Hospital	60,000

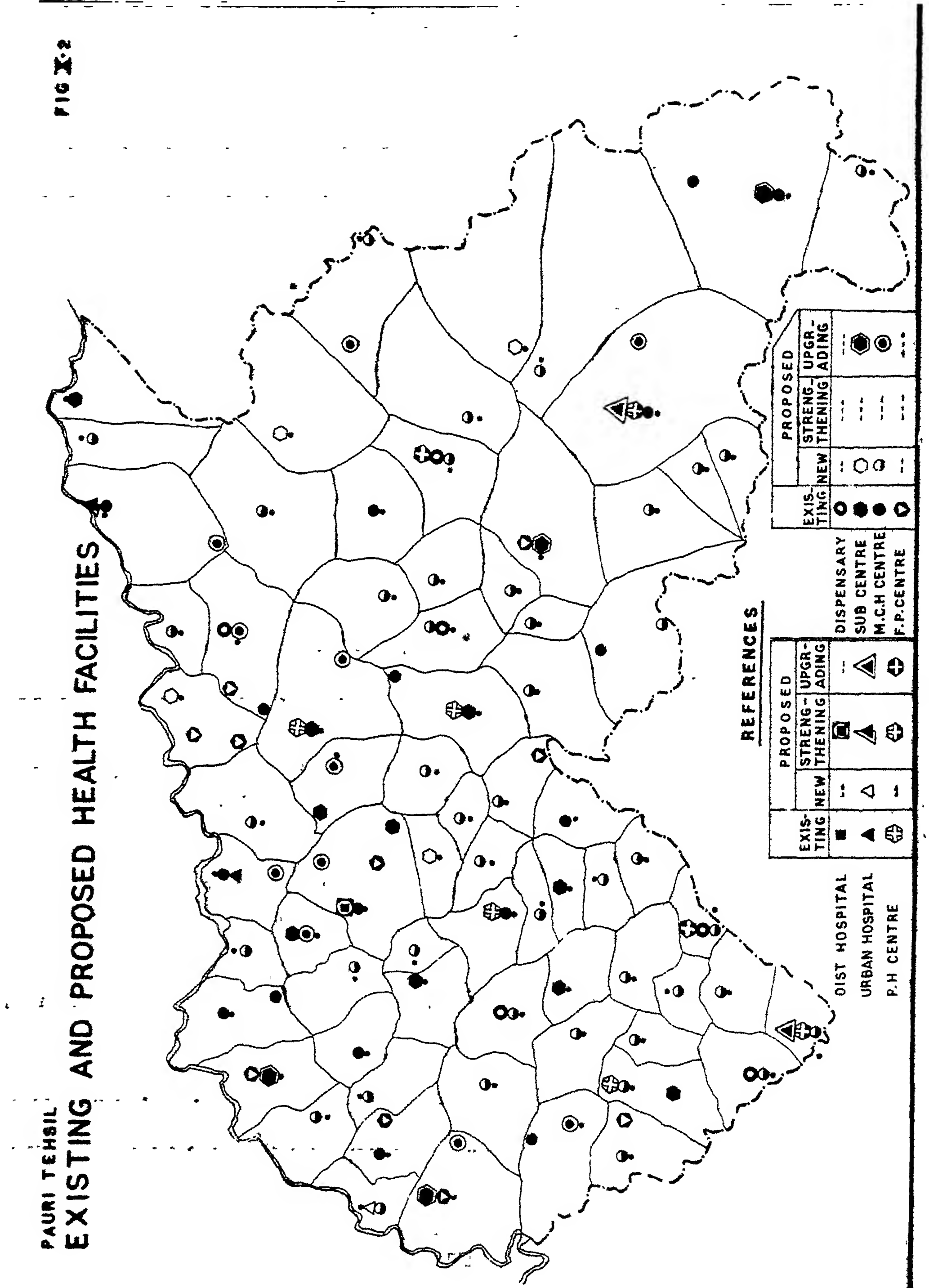
FIG X·2
PAURI TEHSIL
EXISTING AND PROPOSED HEALTH FACILITIES
REFERENCES
EXIS-TING
PROPOSED
NEW
STRENG-THENING
UPGR-ADING
DIST HOSPITAL
URBAN HOSPITAL
P.H CENTRE
DISPENSARY
SUB CENTRE
M.C.H CENTRE
F.P. CENTRE

The Table X.11 indicates the inadequacy of health facilities in the tehsil even at the lowest level. While the population recommended by the Institute of Town Planners is 2,000 for a MCH centre in the rural areas, the tehsil is having one MCH for 6,000 population. In the case of sub-centres the Planning Commission has recommended one unit for every 8,000-10,000 population which has ultimately to be reduced to 4,000-5,000 whereas the average population for one sub-centre existing in the teshil is about 11,000. As regards the primary health centres the Giddar Committee* recommendation seems to be quite realistic.

It recommends one Primary Health Centre for every 20,000 population whereas the existing average population for one PHC in the tehsil is about 23,000. The District Hospital and Urban Hospitals are supposed to serve the district and the urban areas respectively. There is no set population norms for these categories and hence we have not tried to compare. However, it can be seen from Table X.10 that the facilities available in these hospitals are far from satisfactory. These hospitals are not well equipped and the number of doctors, nurses as well as the bed strength is quite inadequate.

PROPOSALS

The Basic Approach and Standards. To work out the programme for the provision of health and medical services the standards have been derived in the following way.

It is obvious that the norms for health facilities in the rural areas in plains can be adopted for this hilly area only with some modifications. The lowest tier of the medical facilities should continue to be the MCH centres and which can be made available for every 3,000 population. This facility should be provided to the small group of population so that those residing in scattered and inacessible settlements will also not be deprived of availing these facilities. In each sub-centre three will be one midwife to take care of the mother and child. Doctors may visit once in a week.

The next order medical unit will be sub-centre. As has been proposed by Planning Commission it will be located for every 10,000 population and a doctor may visit once in a fortnight. The function of this unit will be to take care of mother and child, family planning and treatment for minor ailments to the villagers in general.

Primary health centres will be provied with comprehensive health and medical facilities both curative and preventive for in patients as well as out patients. It will also be a centre for Family Planning. There will be 2 doctors, 1 midwife, 1 health supervisor, 1 compounder and other supporting staff. The total number of beds in each PHC will be 6 and it will serve 20,000 population.

Urban hospitals are recommended for growth centres where there will be clinical laboratories, X-Ray facilities and 12 beds. There will be 2 doctors, 1 compounder, 1 Health Visitor, 1 Midwife and 2 dressers.

In the District Hospital there will be a Civil Surgeon assisted by a team of 4 female and 4 male doctors and other subordinate staff. The minimum number of beds will be 100.

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* Giddar Committee recommends

(*i*) Sub-centres for a group of villages under the charge of the public health nurses to attend mother and children and also to give treatment for minor ailments to the villagers in general.

(*ii*) PHC to provide comprehensive health and preventive medical facilities both curative and preventive on the basis of one centre for 20,000 population.

(*iii*) Small hospitals of 50 beds each having clinical laboratory and X-Ray facilities at appropriate locations.

The Plan. On the basis of the norms formulated above, the requirement of health and medical facilities in the tehsil has been worked out for 1979 and 1984 and presented in Table X.12.

TABLE X 12 : ESTIMATED REQUIREMENT OF HEALTH AND MEDICAL FACILITIES—1979 & 1984

S.No.	Type of Institution	1979					1984				
		Units	Beds	Doctors	Compounders	Midwives	Units	Beds	Doctors	Compounders	Midwives
1.	District Hospital	1	100	9	2	8	1	100	9	2	8
2.	Urban Hospital	5	60	10	5	5	5	60	10	5	5
3.	Primary Health Centre	5	30	10	5	5	6	36	12	6	6
4.	Dispensary	4	16	4	—	—	4	16	4	—	—
5.	Sub-Centre*	14	14	—	—	14	18	18	—	—	18
6.	MCH	61	—	—	—	61	72	—	—	—	72
		90	220	33	12	93	106	230	35	13	109

* Since the family planning programmes are also being implemented through the sub-centres no proposal has been made for new family planning unit.

It is proposed that facilities in the District hospital should be improved by providing specialised treatment in all branches of medical sciences. The bed strength has to be increased from 83 to 100 by 1979. There should be a minimum of 9 doctors and sufficient number of suporting staff in the hospital. In addition to the two urban hospitals* existing at Srinagar and Rudraprayag we recommended three more urban hospitals at Bahbazar, Thailisain and Satpuli so that all the growth centres will have one hospital. These hospitals in addition to catering the needs of the respective centres will serve their hinterland also. The requirement of hospitals at Satpuli and Thailisain can be met by upgrading the existing primary health centres in these two places.

As regards the primary health centres at present only six central villages are possessing these facilities and out of which 2 medical institutions will be upgraded. The requirement of primary health centre, however, will be 6 in 1984. For this, in addition to the existing four primary health centres, the dispensaries at Patisain and Chakisain are also proposed to be upgraded. The remaining four dispensaries will be retained.

Since the sub-centres provide the facilities of a family planning unit also we have not recommended any new family planning unit in the tehsil. The requirement of sub-centres for 1984 is estimated as 18. The proposed sub-centres are shown in Appendix X.9.

* According to 1971 census few of the growth centres are not urban centres. We feel the classification of rural and urban areas based on the demographic characteristics is unrealistic as adopted in census. If we take into account the physical structure and level of functions all the growth centres can be considered as urban centres.

TABLE X.13 : PROPOSED IMPROVEMENT IN HEALTH AND MEDICAL FACILITIES 1974-79

S. No.	Type of Unit	Existing					New Construction					Strengthening					Total 1979				
		Units	Bed	Doctor	Compounder	Midwife	Unit	Bed	Doctor	Compounder	Midwife	Unit	Bed	Doctor	Compounder	Midwife	Unit	Bed	Doctor	Compounder	Midwife
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1.	District Hospital	1	83	6	2	8	—	—	—	—	—	1	17	3	—	—	1	100	9	2	8
2.	Urban Hospital	2	48	3	2	3	1	12	2	1	1	1	2	1	—	1	3	62	6	3	5
3.	P.H.C.	6	22	6	6	4	—	—	—	—	—	2	6	—	—	2	6	28	6	6	6
4.	Dispensaries	6	24	6	—	—	—	—	—	—	—	—	—	—	—	—	6	24	6	—	—
5.	Sub-centre	10	10	—	—	10	4	4	—	—	4	—	—	—	—	—	14	14	—	—	14
6.	M.C.H.	17	—	—	—	17	44	—	—	—	44	—	—	—	—	—	61	—	—	—	61
	Total	42	187	21	10	42	49	16	2	1	49	4	25	4	—	3	91	228	27	11	94

The MCH centres are proposed to be widely distributed all over the tehsil. We propose that in each central village there should be a MCH centre. However, in centres having sub-centre, there is no need for a MCH unit. However, the MCH units existing at present in dependent villages will be retained. The requirement of MCH units for 1979 and 1984 are estimated as 61 and 72, respectively (Appendix X.10).

Phasing of programme. For the effective implementation of the programme recommended, a phasing of the schemes seems to be inevitable. Since a large area in the tehsil is not having any medical facilities, our attempt should be primarily to increase the number of units in the first phase so that maximum population will make use the services. As regards the improvement of the existing units, only such centres where there is a gross inadequacy of facilities will be included in the first phase. All upgrading work will be taken up in the second phase, along with general improvement in the quality of services.

Based on the above phasing of the recommendations have been made to be implemented during 1974-79 and 1979-84. The proposed programme in the first phase is shown in Table X.13.

During 1974-79, 49 new units are proposed to be constructed in the tehsil. This includes one hospital at Bahbazar, four sub-centres at Bubakhal, Melkakhal, Bhattisera and Gadoli. Remaining 44 units are MCH centres proposed to be located in the central villages. In addition to this, the exsting facilities in four institutions are proposed to be improved. These units are the District Hospital at Pauri, Urban Hospital at Rudraprayag, the Primary Health Centre at Thailisain and Satpuli.

TABLE X.14 : PROPOSED IMPROVEMENT IN HEALTH AND MEDICAL FACILITIES, 1979–84

S. No.	Type of Unit	New Construction	Upgrading	Strengthening	Total 1984				
					Units	Bed	Doctor	Compounder	Midwife
1.	District Hospital	—	—	—	1	100	9	2	8
2.	Urban Hospital	—	2	—	5	86	10	5	5
3.	P.H.C.	—	2	4	6	36	12	6	6
4.	Dispensary	—	—	—	4	16	4	—	—
5.	Sub-centre	—	4	—	18	18	—	—	18
6.	M.C.H.	12	—	—	72	—	—	—	72
	Total	12	8	4	106	256	35	13	109

In the second phase (Table X.14) the primary health centres located at Satpuli and Thailisain are proposed to be upgraded as urban hospitals. During the same period the dispensaries at Patisain and Chakisain are proposed to be upgraded as PH Centres. With this upgrading the total number of Primary Health Centres in the teshil during 1984 will be 6.

In addition to these, the MCH/Family Planning unit located at Ghindwara, Jamalkhal, Bungidhar and Nautha have to be upgraded as sub-centres. The new construction during this period will be limited to 12 MCH centres in the different central villages (Appendix X.10). Besides the upgrading and new construction, the existing facilities will have to be improved in all the centres during this period to have at least the minimum requirement as specified in the basic approach for planning of health facilities.

CHAPTER XI

A PROPOSED TRANSPORTATION SYSTEM FOR PAURI TEHSIL

We have seen earlier that the three basic problems which have prevented an all-around development of the study area are : (1) the absence of an efficient water management system, (2) the absence of an efficient transportation system and (3) the absence of power. We have proposed a programme for water management in Chapter IV. A proposal for extensive rural electrification has been suggested in the next chapter. In the present chapter, we propose to analyze the present transportation situation in the study area and recommend an efficient transportation system linking the resource areas with markets and industrial and urban centres for a smooth and unobstructed movement of goods and people. It is needless to emphasize that the mere presence of a transportation system unrelated to other development activities does not by itself initiate development. A transportation system must be integrated with the rest of the economy in order to be effective. Ideally, input distribution, marketing, credit, storage, processing as well as educational and medical facilities should be easily accessible to all villages in an area. Topographically, Pauri is a far cry from an ideal area where this can be done easily. In this study, we have assessed the present adequacy and future requirements of the transportation system in the tehsil in the light of our earlier recommendations for the development of the different sectors of economy. Proposals have been made for augmenting the capacity of existing roads and for constructing new ones wherever the situation warranted them. In doing this, special attention has been given to the difficult topography of this area.

The whole sequence of analysis is divided into logical stages. First, the utilization of existing roads and the composition of traffic have been analysed for identifying missing links. Projections were then made for the future with reference to our earlier recommendations for the improvement of the main sectors of the economy which have a bearing on transportation such as population, agriculture, horticulture, industrial production and so on. Our final recommendations for the establishment of an efficient transportation system in the study area are based on these projections after making allowance for the existing capacity of roads now in use.

The Existing Transportation System

The present transportation system in the tehsil consists of network of roads connecting a few important market centres. The tehsil is not connected by railway. The perennial rivers namely Alaknanda and the Nayars facilitate the transportation of timber logs during rainy seasons.

The tehsil had a total road kilometreage of 303 in June, 1973 under the Public Works Department (PWD), the Forest Department and the border road unit of the defence services. Out of this, 117 Kms of road had bituminous road surfacing as against 106 Kms of waterbound macadam road and 106 kilometres of kutcha roads. Most of the roads are single-lane with a carriage-way of 8′ to 16′. The roads in the tehsil are susceptible to floods as well as land sliding and traffic is interrupted during monsoon.

Among the road sections in the tehsil, the most important one is the State Highway connecting Kotdwara, Satpuli, Pauri and Srinagar. It further links up the tehsil with Chamoli and Tehri-Garhwal districts.

The other important road sections are : Pauri-Nautha, Pauri-Safdarkhal, Pauri-Phurkandakhal, Pauri-Kanskhet, Satpuli-Kanskhet and Srinagar-Rudraprayag.

Villages are connected with these major arteries by bridle-paths and footways.

Capacity of Roads

Road capacity is measured in terms of the maximum number of vehicles that can pass a given point on a day without reasonable traffic delay. Since the capacity depends on several factors such as speed and mix of vehicles, width and geometrics of roads, it is rather difficult to have a set of norms which will establish the capacity values. For the purpose of this report, the capacities of different orders of roads as suggested by the Joint Technical Group for Transport, Planning Commission, have been used. Suggestions made by the Technical Group are as follows :

TABLE XI.1 : CAPACITY OF ROAD SECTIONS

S.No.	Specification of roads	Daily capacity in Pcu's*
1.	Ordinary single-lane roads with earth shoulders 2′ wide	1000
2.	Single-lane roads with improved shoulders each 5′ wide	3000
3.	Two-lane roads under ideal conditions	10000

* Pcu=Passenger Car Unit

Based on these figures and giving due allowance to the nature of road surface, capacities have been worked out and presented in Table XI.2. Since a few road sections do not have a uniform width throughout its length, the capacity is assumed as varying. Thus the capacity of Satpuli-Pauri road ranges between 1000 and 3000 passenger car units.

Utilization of Roads : Traffic Volume Survey

To measure the level of utilization of roads, a detailed traffic volume survey was carried out during June, 1973 in the major road sections of the tehsil. Altogether 8 census points were chosen within the tehsil and the survey was conducted for 24 hours continuously from 6.00 A.M. on June 25-26, 1973. The number of vehicles that passed through each of the census point was recorded and added up to get the total volume of traffic at each census point. However, since the traffic consisted of different types of vehicles, each mode of transport was converted into equivalent passenger car units. The passenger car units for this conversion was based on the recommendations of the Ministry of Transport, Govt. of India (Table XI.2).*

* Passenger Car Unit (Pcu) is the unit of measuring the capacity of road. It is the proportionate value assigned to each mode of transport taking into account the time taken and road width occupied by such vehicles as compared with a motor car.

TABLE XI 2 : PASSENGER CAR EQUIVALENT FOR DIFFERENT TYPES OF VEHICLES

S.No	Type of vehicles	Passenger Car Units
1.	Motor cars, station wagons and pick up vans	1
2.	Motor cycles, scooters	1
3.	Buses and lorries	3
4.	Tractors, tractor-trailor combinations	3
5	Bullock carts, jatkas and handdrawn carts	6
6.	Cycles	0 5

The total volume of traffic in equivalent passenger car units for different roap sections is shown in Table XI.3

Comparing the actual volume of traffic and the capacity of road sections the level of utilization is determined. From Table XI.3, it can be seen that the level of utilization of roads in the tehsil varies from 5.3 per cent in the Bubahkal-Khirsu road section to 77.1 per cent in some sections of the Rishikesh Srinagar road. Many road sections show under-utilization and it is attributed to the poor state of development of the tehsil and the lack of feeder roads.

Composition of Traffic

An analysis of the composition of vehicles shows that buses and trucks out number other modes of conveyance. Motor cars, scooters and cycles are very few in number. Steed gradients and acute curves make the traffic of light vehicles difficult and quite often risky. As regards the composition of total traffic, it is observed that the percentages of passenger traffic and goods traffic were 71.7 and 28.3, respectively.

The quantity and percentage volume of goods under different categories which moved through roads during the census day are shown in Table XI.4.

It can be seen from Table XI.4 that foodgrains, commercial goods and construction materials constituted about 95 per cent of the total goods movement in the tehsil. The movement of foodgrains was the heaviest followed by commercial goods and construction materials. The bulk movement of foodgrains to the tehsil confirms our earlier conclusion regarding the acute shortage of food products in the tehsil. The chief commercial goods transported to the tehsil were textiles, stationary goods, footwear and other provisions. A major portion of the construction material transported to the tehsil was timber which is available in plenty in the tehsil. The dependency of the tehsil on other areas for timber is obviously due to a lack of processing facilities in the tehsil.

Origin and Destination of Goods Traffic: Origin and Destination Survey

In order to identify the production and consumption centres of goods, we conducted an origin and destination survey for goods traffic along with the traffic volume survey. Each goods vehicle was stopped at the census points and enquiries were made regarding : 1. place of origin and destination of goods, 2. commodities carried and weight for each item, and 3. commodities loaded and unloaded at intermediate stations.

TABLE XI 3 : TRAFFIC VOLUME AND CAPACITY OF ROAD SECTIONS, PAURI TEHSIL—1973

S. No.	Name of the Road	Location of the census point	Lorries	Buses	Motor car/ jeep	Motor-cycle and scooter	Cycles	Slow running vehicles	Total volume	Capacity	Level of utilization (in percentage)
1	2	3	4	5	6	7	8	9	10	11	12
1.	Pauri-Kotdwara	Bubakhal	117	141	12	—	—	—	270	1000—3000	9.0 to 27
2.	Pauri to Kotdwara	Patisain	114	138	15	—	—	—	267	1000—3000	8.9 to 26.7
3.	Bubakhal to Pabau	Sungerkhal	6	48	2	—	1	—	57	1000	5.7
4.	Bubakhal to Khirsu	Sungerkhal	6	48	9	—	2	—	53	1000	5.3
5.	Pauri to Bahbazar	W. Hospital	6	12	34	4	2	—	65	1000	6.5
6.	Pauri to Srinagar	Bhaktyana	69	69	21	—	6	—	165	1000—3000	5.5 to 16.5
7.	Rishikesh to Srinagar	I.T.I. Srinagar	144	360	63	10	80	24	681	1000—3000	22.7 to 77.1
8.	Srinagar to Rudraprayag	M.C.P. Srinagar	120	360	82	2	44	—	608	1000—3000	20.2 to 60.6

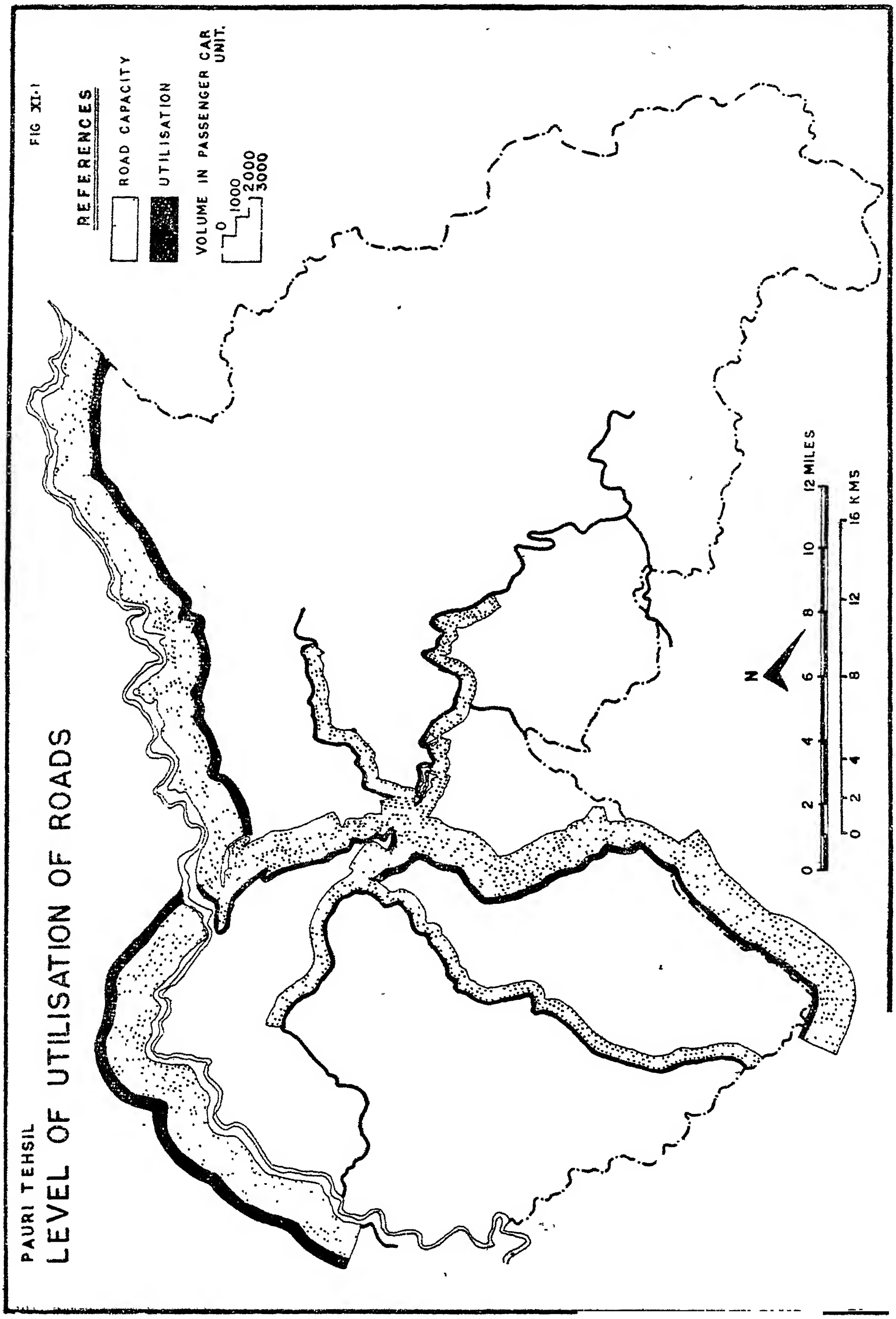
TABLE XI.4 : COMMODITY-WISE MOVEMENT OF GOODS—1973

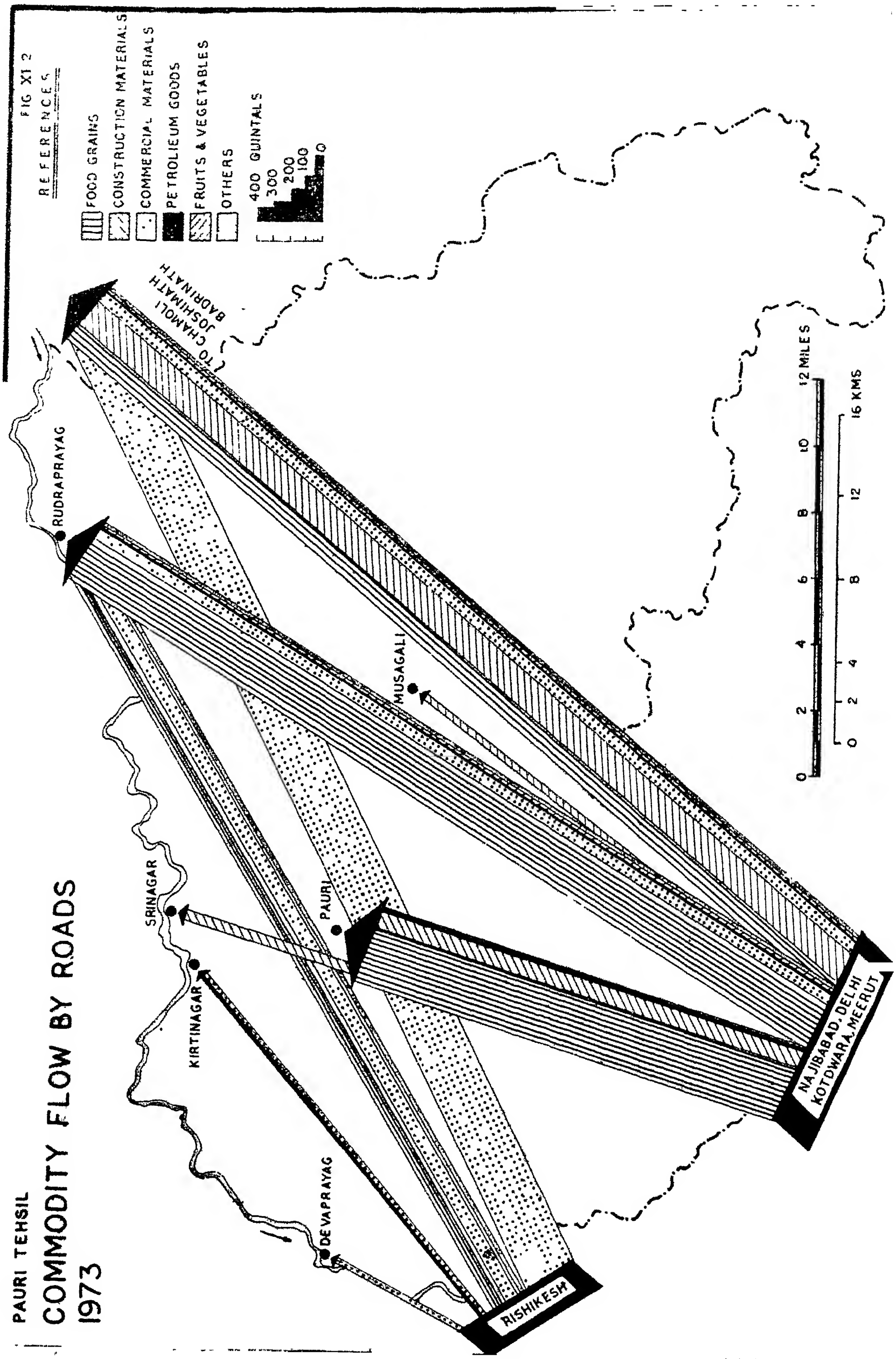
S.No.	Name of Commodity	Quantity in quintals	Percentage to total
1.	Foodgrains	1132	44 4
2.	Commercial goods	857	33.65
3.	Construction materials	408	16.02
4.	Petroleum products	28	1.10
5.	Fruits and vegetables	59	2.32
6.	Others	63	2.47
	Total	2547	100.00

The above enquiry enabled us to pinpoint the production and consumption centres. Details of origin and destination of the goods traffic in the tehsil can be seen in Table XI.5. The figures in the table refer to the weight of goods during the 24 hours of survey on June 25-26.

TABLE XI.5 : ORIGIN AND DESTINATION OF GOODS

S. No.	Origin	Destination	Commodities in quintals						Total
			Food-grains	Cons-truc-tion mate-rials	Com-mercial goods	Petro-leum goods	Fruit & vege-tables	Others	
1	2	3	4	5	6	7	8	9	10
1.	Kotdwara	Musagali	—	36	—	—	—	—	36
2.	Kotdwara	Pauri	444	—	—	—	2	—	446
3.	Kotdwara	Srinagar	—	—	73	—	—	—	73
4.	Kotdwara	Rudraprayag	379	—	80	—	20	30	509
5.	Kotdwara	Chamoli Joshi Math	142	229	75	—	29	15	490
6.	Najibabad	Pauri	—	83	—	—	—	—	83
7.	Delhi	Pauri	—	60	—	8	—	—	68
8.	Delhi	Rudraprayag	—	—	—	10	—	—	10
9.	Delhi	Chamoli Dist.	—	—	—	10	—	—	10
10.	Rishikesh	Hindolakhal	40	—	—	—	—	—	40
11.	Rishikesh	Deoprayag	—	—	40	—	—	—	40
12.	Rishikesh	Maktha guinth	—	—	40	—	—	—	40
13.	Rishikesh	Kirtinagar	20	—	25	—	—	—	45
14.	Rishikesh	Rudraprayag	107	—	112	—	8	18	245
15.	Rishikesh	Chamoli Dist.	—	—	412	—	—	—	412
16.	Srinagar	Pauri	—	36	—	—	—	—	36
		Total	1132	408	857	28	59	63	2547


PAURI TEHSIL
LEVEL OF UTILISATION OF ROADS
FIG XI·1
REFERENCES
ROAD CAPACITY
UTILISATION
VOLUME IN PASSENGER CAR UNIT.
0
1000
2000
3000
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS


PAURI TEHSIL
COMMODITY FLOW BY ROADS
1973
FIG XI 2
REFERENCES
FOOD GRAINS
CONSTRUCTION MATERIALS
COMMERCIAL MATERIALS
PETROLIEUM GOODS
FRUITS & VEGETABLES
OTHERS
400 QUINTALS
300
200
100
0
TO CHAMOLI JOSHIMATH BADRINATH
RUDRAPRAYAG
MUSAGALI
SRINAGAR
PAURI
KIRTINAGAR
DEVAPRAYAG
RISHIKESH
NAJIBABAD, DELHI KOTDWARA, MEERUT
0 2 4 6 8 10 12 MILES
0 4 8 12 16 KMS

From the Table XI.5 it can be seen that the foodgrains in the tehsil are brought mainly from Kotdwara and Rishikesh which are major collection and distribution centres. For construction materials and commercial goods, the tehsil also depends on Najibabad and Delhi. It can also be noted that the movement of goods is one sided. While a bulk of the goods are transported to the study area, there is no outward movement of goods. An analysis of the origin and destination of the traffic in different distance ranges indicates that long distance traffic is more frequent than the short distance traffic (Table XI.6).

TABLE XI 6 : ORIGIN AND DESTINATION OF TRAFFIC UNDER DIFFERENT DISTANCE RANGES

S. No.	Distance Range	Percentage
1.	0—25 Kms	Nil
2.	25—50 Kms	1.4
3.	50—100 Kms	—
4.	100—200 Kms	51.0
5.	Above 200 Kms	47.6

Table XI.6 indicates that about 99 per cent of the traffic in the tehsil has a distance lead of more than 100 Kms. This again supports our earlier inference that a major portion of the tehsil's income is spent on transportation cost.

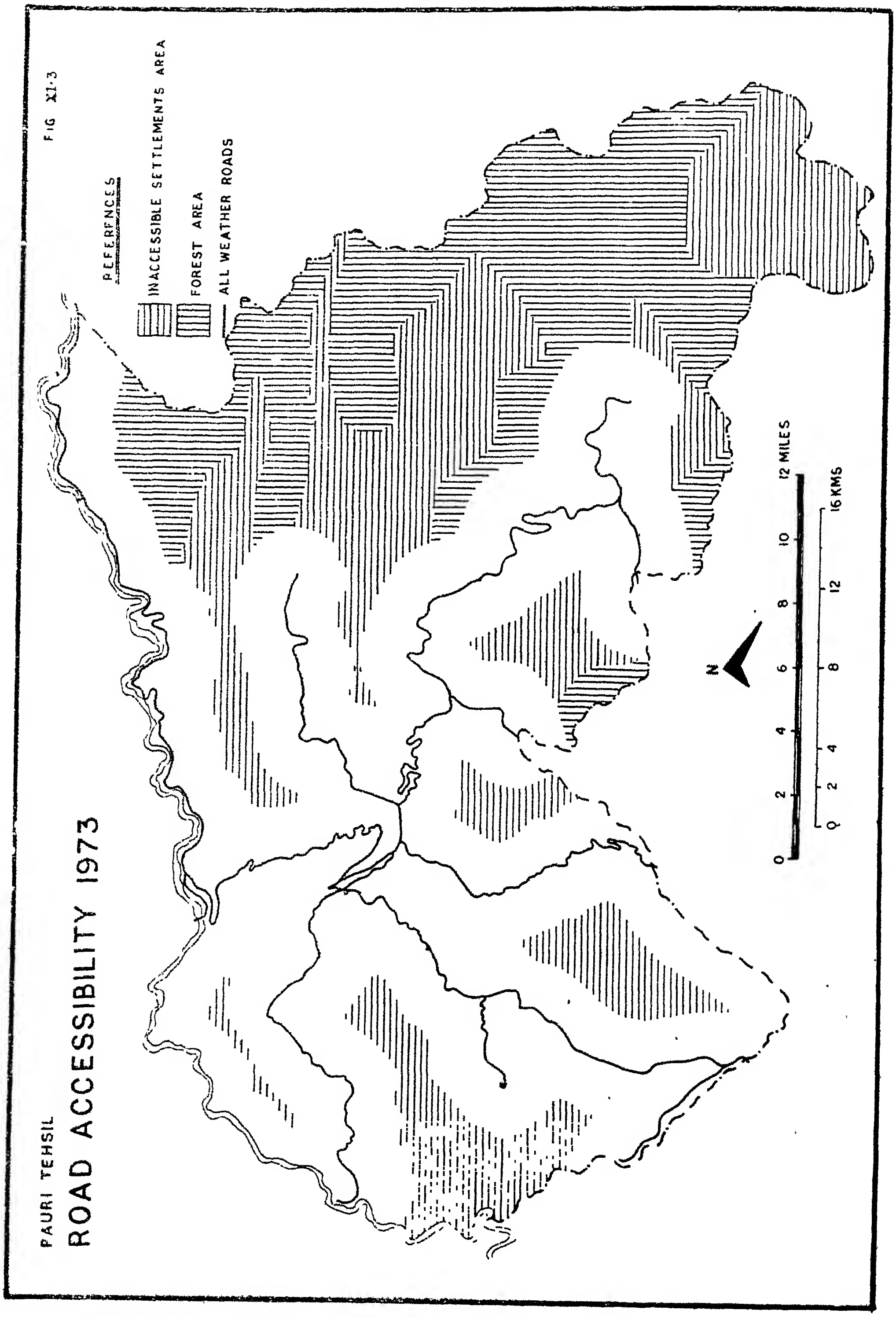
Road Accessibility

The preceding analysis on the overall position of the tehsil in respect of road mileage, level of utilization of roads and the composition of traffic is, however, insufficient to identify the areas which are inaccessible and are poorly served by roads. In order to assess road accessibility, standards suggested in the Nagpur and Bombay Plans of the Indian Road Congress may be used (Table XI.7).

TABLE XI.7 : CRITERIA FOR ACCESSIBILITY OF VILLAGES (IN KILOMETRES)

Description of Area	Maximum Distance of any Village	
	From any road	From main road
Nagpur Plan		
Agricultural Area	3.22	8.05
Non-Agricultural Area	8.05	32.10
Bombay Plan		
Developed Agricultural Area	2.41	6.44
Semi-developed Area	4.83	12.87
Underdeveloped Area	8.05	19.31

The spatial distribution of settlements and the level of development of the area suggest that the accessibility standards set by the Bombay Plan of 12.87 Kms from an all-weather motorable roads can be used. Villages which are located at a distance of more than 12.87 Kms in the tehsil are shown in Appendix XI.3. According to this standard, 377


PAURI TEHSIL
ROAD ACCESSIBILITY 1973
FIG XI·3
REFERENCES
INACCESSIBLE SETTLEMENTS AREA
FOREST AREA
ALL WEATHER ROADS
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

inhabited villages in the tehsil are inaccessible and the total inaccessible area (525 sq. Kms.) is 23.6 per cent of the total geographical area of the tehsil. The inaccessible pockets are confined mostly to the eastern half of the tehsil.

Future Volume of Traffic

Information presented in the preceding sections on the characteristics of traffic in the tehsil and on areas not adequately served by transportation emphasizes the need for a well-coordinated transportation plan for the area. A perspective plan of 10 years must also take into account the future pattern of movement of passengers and goods and their volume has also to be taken into account. Projections have, therefore, been made to predict both passenger and goods traffic in the tehsil for the years 1979 and 1984.

Projection of Passenger Traffic

The overall demand for passenger services is influenced by the size and location of population, their personal income, people's social habits and price of transport. Data on these are not easy to collect and usually the volume of future passenger traffic is estimated by extrapolating past trends.

In the study area, even past data on traffic volume were not available. We have used the only other alternative statistics furnished by the different transport agencies on the annual collection of bus fares from 1969 to 1973. We converted the passenger fares into passenger kilometres by dividing the former by the per kilometre fare. The growth rate of passenger kilometres by year calculated from these figures was then used for estimating future volumes of passenger traffic by bus for the years 1979 and 1984. The analysis was done for each road section. The minimum growth rate was observed in the Pauri-Bahbazar road section (6 per cent) whereas the maximum was in the Rishikesh-Srinagar road (10 per cent). The average rate of growth for the tehsil as a whole was 7.8 per cent. The future volume of passenger traffic by other modes of traffic such as motor car, scooter, etc. was estimated by applying the same growth rate on the current volumes.

Projection of Goods Traffic

In the case of passenger traffic, past trends provided the basis for predicting future traffic volumes. No such guidelines were available for estimating future goods traffic. We have, therefore, based our estimates entirely on the projected production and consumption figures for agricultural, horticultural, industrial and forest and animal-based products. It may be recalled that these projections were made in the previous chapters. The geography of the resource areas and the recommended locations for marketing, storage and processing also provided base for these estimations. Seasonal variations in these activities were also taken into account.

In determining the future volume and direction of goods traffic, the commodities were divided into different categories namely, foodgrains, forest products, fruits and vegetables, livestock products, industrial and commercial goods, etc. In deciding the lines of movement of foodgrains, the cluster-wise production, consumption, surplus/deficit were taken into account. It was assumed that the deficit in one cluster would be made up by supplies from the nearest clusters with surpluses. It was also assumed that the remaining surplus would first go to one of the three proposed regulated markets namely, Pauri, Satpuli and Thailisain before finding its way out. On the basis of the present trends, it was assumed that food imports would mainly come from Kotdwara and Rishikesh.

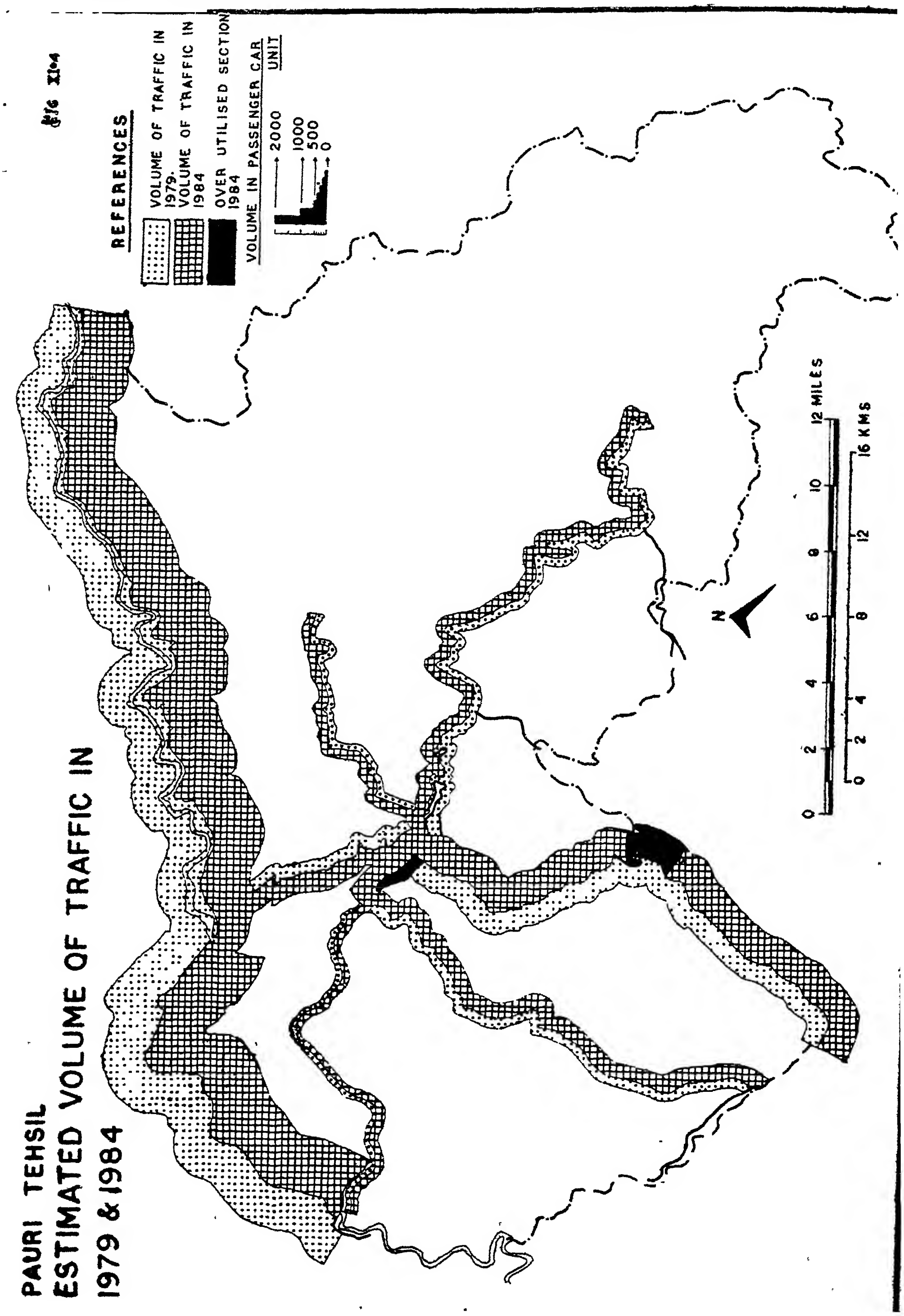


Fig XI·4
PAURI TEHSIL
ESTIMATED VOLUME OF TRAFFIC IN
1979 & 1984
REFERENCES
VOLUME OF TRAFFIC IN 1979.
VOLUME OF TRAFFIC IN 1984
OVER UTILISED SECTION 1984
VOLUME IN PASSENGER CAR UNIT
2000
1000
500
0
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

For the transportation of fruits, vegetables, livestock products, industrial goods, etc. the locational decisions taken in respect of their production and consumption in the respective chapters were used. A large volume of the raw materials required for the proposed Satpuli Paper Mill can be transported by rivers and the remaining volume by road. The estimated volume of the manufactured products were then allocated to different road sections by which they are likely to move from Satpuli to the various consumption centres.

The future traffic volume of commercial goods and construction materials was obtained by applying the general growth rate of the aggregate traffic volume of other commodities on the current flows of these two commodities.

The existing capacities of the different road sections in the tehsil and the estimated volumes of passenger and goods traffic they will carry in 1979 and 1984 are shown in Table XI.8.

It can be seen from the above table that a few sections of the Srinagar-Rishikesh road where the road shoulder is less than 5′ and with a capacity of only 1000 passenger car units will be overutilized by 1979 and parts of the Pauri-Satpuli road with a capacity of 1000 Pucs will reach overutilization only by 1984. All other sections will remain underutilized even in 1984.

Transportation Problems and Policies For Future Development

The preceding analysis of the expected traffic volumes and the utilization of the existing main roads shows that much of the roads will remain unutilized in the future. Most of the traffic that flows along these roads is from one urban centre to another. Some of the passengers and a part of the goods carried in this flow will reach the villages also but the low degree of overall utilization of the roads indicates that the town to village traffic emanating from the major traffic flows cannot be very large. One cannot also expect a great deal of such traffic because these main roads are not connected with a very large number of villages by link roads.

In the earlier chapters, we came back to the problem of general inaccessibility of the area over and over again and the existing road lengths are obviously not enough to open up the vast resource areas of the tehsil and also to bring the villages now obstructed by an inhospitable terrain, into the mainstream of development. As we have observed earlier, the absence of a suitable transportation system in the tehsil is one of the very basic problems of the area and must be removed before any improvements can be expected in the overall economic backwardness. The emphasis of a perspective transportation plan for the area must, therefore, be on link roads connecting villages with the main production and market centres of the area and on main roads where none exists. The alignment of these roads should be formulated within the general framework of our locational recommendations based on the functional importance of central villages, service centres and growth centres and their interlinkages.

Our observations on the existing road system in the tehsil are summarized below :

1. The total existing road length is extremely inadequate for making the whole area accessible.

2. The existing road network forms a closed system which restricts the potentiality of the roads for opening up surrounding areas and increases distance.

3. The inadequacy of the existing road network makes very little contribution to the physical integration of the settlements in the tehsil.

TABLE XI.8 : ESTIMATED VOLUMES OF PASSENGER AND GOODS TRAFFIC IN 1979 AND 1984

S. No.	Name of the road	Census point	Passenger Traffic in PCUS		Goods Traffic in PCUS		Total Traffic in PCUS		Capacity of road	Utilization in percentage	
			1979	1984	1979	1984	1979	1984		1979	1984
1	2	3	4	5	6	7	8	9	10	11	12
1.	Pauri to Satpuli	Bubakhal	375	481	432	712	807	1193	1000 to 3000	26.9 to 80.7	39.8 to 119.4
2.	Pauri to Satpuli	Patisain	371	475	413	660	784	1135	1000 to 3000	26 5 to 79.5	37 8 to 113.4
3.	Prabakhal to Pabau	Sungarkhal	74	91	126	213	200	304	1000	19.5	27.4
4.	Bubakhal to Khirsu	Sungarkhal	90	104	105	170	195	274	1000	19 5	27.4
5.	Pauri to Bahbazar	W. Hospital, Pauri	75	93	7	13	82	106	1000	8.2	10 6
6.	Pauri to Srinagar	Bhabtiyana	216	267	231	382	447	649	1000 to 3000	14 9 to 44 7	21 6 to 64.8
7.	Rishikesh to Srinagar	I.T.I., Srinagar	1022	1362	460	738	1482	2100	1000 to 3000	49 4 to 138 2	70.0 to 210 0
8.	Srinagar to Rudraprayag	M.C.P., Srinagar	912	1216	604	985	1516	2201	1000 to 3000	50 5 to 151.5	76.7 to 220 1

4. Insufficient road shoulders and sharp bends increase road accidents.

In order to overcome the above deficiencies, a 10-year transportation development programme has been worked out in two phases of 5 year duration each. The following policies were followed in formulating this programme.

1. All central villages (exclusive of the three central villages for which ropeway has been proposed) should be linked by all-weather motorable roads.
2. All settlements should be accessible to the main road at least by a footpath of 3′ wide and having a gradient less than 1 in 5.
3. All service centres where weekly markets have been proposed should be linked directly to the proposed regulated markets.
4. The design capacity of the roads should be such as to ensure free and uninterrupted flow of traffic.

Two other principles have also been given due consideration. First, no area except the forests in the district should be at a distance of more than 12.87 Kms from an all-weather motorable road. Secondly, all all-weather motorable roads should form an open transportation system in order to offer choice of routes and to minimise distance.

Development Proposals

On the basis of the above policies, 29 new road sections constituting a total length of 347 Kms have been proposed in the tehsil. Out of this, 70 Kms is proposed to be constructed by the forest department and the remaining by the PWD. In the first phase (1974-79) a road length of 188 Kms is proposed to be constructed. This includes a few sections for which sanction has already been accorded by the State Government. In the second phase the remaining road length of 159 Kms is proposed to be covered. In fixing priority for the construction of roads, the following considerations were taken into account : the size of population to be served and the development activities proposed in agriculture, horticulture, animal husbandry, industry, etc. in each centre. As regards the agency for the maintenance of roads, it is proposed that all road sections passing through the reserved forest areas should be under the control of the forest department. Road sections proposed for 1979 and 1984, the kilometreage and important centres that will be connected are shown in Tables XI.9 and XI.10.

The roads should be surfaced to facilitate transport throughout the year and a carriage way of 12′ width with slide shoulders of 2′—5′ are recommended.

The following road lengths require widening and easing of curves :

1. Jalapadevi bridge to Piplipani
2. Bubakhal to Pauri
3. Bungwari to Gaduagad
4. Premnagar to Bichilirani
5. Srinagar to Pauri kilometre 3/0 to 5/0

In addition, the following earthen roads must be upgraded to water bound macadam roads :

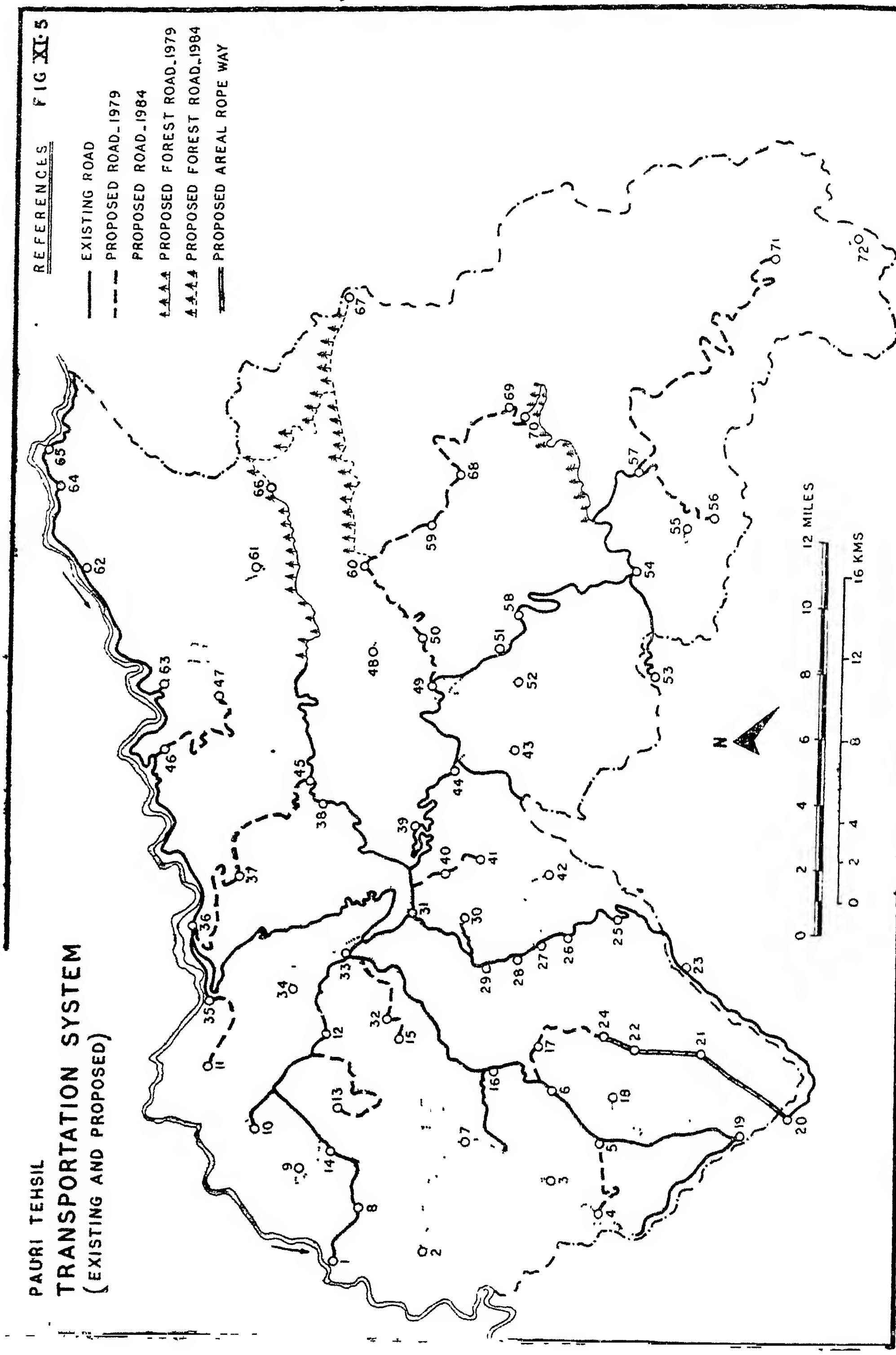
Satpuli—Kanskhet
Pabau—Santudhar
Pauri—Kanskhet
Pauri—Phurkhundakhal
Adwani—Nahsair

TABLE XI.9 : PROPOSED ROADS IN PAURI TEHSIL (1974–1979)

S. No.	Name of Road	Places to be connected	Length in km	Agency for execution
1	2	3	4	5
1.	Dandapani to Jamlakhal	Dandepani and Jamlakhal	6 km	PWD
2.	Khandiunsain to Kot	Khandiunsain to Kot	7 km	PWD
3.	Pauri to Lwali	Pauri, Daduadevi and Lwali	12 km	PWD
4.	Ghandiyal to Diusi	Ghandiyal and Diusi	7 km	PWD
5.	Kanskhet to Mundneshwar	Kanskhet, Kaljikhal and Mundneshwar	11 km	PWD
6.	Sungarkhal to Sihukhal	Sungarkhal, Bhainswara and Sikukhal	8 km	PWD
7.	Srinagar to Khirsu	Srinagar, Sumari and Khirsu	22 km	PWD
8.	Bhattisera to Kherakhal	Bhattisera and Kherakhal	12 km	PWD
9.	Khirsu to Molkakhal	Khirsu and Molkakhal	12 km	Forest Department
10.	Chifalghat to Paithani	Chifalghat, Sankarsain and Paithani	15 km	PWD
11.	Paithani to Tarpali	Paithani, Chakisain, Chaunoa, Gadoli	20 km	PWD
12.	Thailisain to Bhira	Thailisain and Bhira	6 km	PWD
13.	Thailisain to Bungidhar	Thailisain and Bungidhar	30 km	PWD
14.	Tarpali to Thailisain	Tarpali and Thailisain	20 km	Forest Department
		Total road in km	188 km	

TABLE XI.10 : PROPOSED ROADS IN PAURI TEHSIL, 1979-1984

S. No.	Name of the Road	Places to be connected	Length in km.	Agency for execution
1.	Kholachaunri to Kamalpur	Kholachaunri and Kamalpur	4	PWD
2.	Lwali to Ghindwara	Lwali and Ghindwara	18	PWD
3.	Nahsain to Baganikhal	(Pauri-Ghindwara road to be connected to Nahsain and Baganikhal)	10	PWD
4.	Diusi to Sarora	Diusi and Sarora	11	PWD
5.	Pundori to Saknikhet	Pundori and Saknikhet	7	PWD
6.	Agrora to Pokhrikhet	Agrora and Pokhrikhet	8	PWD
7.	Pauri to Kyark	Pauri and Kyark (*via* Premnagar)	9	PWD
8.	Khankara to Barsuri	Khankara and Barsuri	16	PWD
9.	Pabau to Champeshwar	Pabau and Champeshwar	7	PWD
10.	Chifalghat to Bajwar	Chifalghat and Bajwar	8	PWD
11.	Paithani to Gidokhal	Paithani and Gidokhal	25	Forest Department
12.	Sankarsain to Mailisain	Sankarsain and Mailisain	6	PWD
13.	Paithani to Molkakhal	Chifalghat— Gidokhal Road to be connected to Molkakhal	13	Forest Department
14.	Bhira to Pokhri	Bhira and Pokhri	2	PWD
15.	Bungidhar to Samoya	Bungidhar and Samoya	15	PWD
		Total	159	


PAURI TEHSIL
TRANSPORTATION SYSTEM
(EXISTING AND PROPOSED)
FIG XI·5
REFERENCES
EXISTING ROAD
PROPOSED ROAD_1979
PROPOSED ROAD_1984
PROPOSED FOREST ROAD_1979
PROPOSED FOREST ROAD_1984
PROPOSED AREAL ROPE WAY
N
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

Ropeways

While proposing new roads for connecting inaccessible central villages, it was found that three centres namely, Mundaneshwar, Mawadhar and Kandarpani cannot be linked by roads due to the rugged terrain and steep slopes all around these centres. On the other hand, the hinterlands of these centres have rich potentialities for livestock and horticultural development. We have proposed in Chapter VIII that this area should be included in the milkshed area of Satpuli dairy project and the expected collection of milk in the chilling plants at Mundaneshwar and Kandarpani during 1979 and 1984 will be 6,000 litres and 9,000 litres, respectively. We have also proposed an orchard covering an area of 355 hectares in the Mundaneshwar cluster. These development programmes are possible only if this area has proper accessibility.

At present, there is no market centre in this area and people depend on Satpuli for their marketing and other facilities. They travel by ponies and collect foodgrains and goods from Satpuli covering a distance of more than 15 kilometres. The above problems highlight the imperative need of linking this area with the market centre at Satpuli. There is, however, hardly any possibility for the construction of a road within a reasonable cost. Besides, cutting of the steep slope may lead to land sliding. As an alternative mode of transport we recommend an aerial ropeway for this mountainous terrain connecting Mundaneshwar and Satpuli.

The proposed ropeway will serve 59 villages scattered in three clusters namely, Mundaneshwar, Mawadhar and Kandarpani. The 1971 population of these villages was estimated as 6,900 and the projected populations in 1979 and 1984 are 7,700 and 8,200, respectively. In addition to the passenger traffic, the ropeway will carry foodgrains, fruits, vegetables and chilled milk from the chilling plants at Mundaneshwar and Kandarpani to Satpuli.

Technical Norms of Proposed Aerial Ropeway*

The aerial ropeway proposed between Mundaneshwar and Satpuli will have a capacity of 1.5 tons both uphill and down-hill. It will connect three intermediate stations namely, Mawadhar, Kandarpani and Dabnu. The total length of the ropeway will be 11.6 Kms and will have two sections: Mundaneshwar to Kandarpani (5.5 Kms.) and Kandarpani to Satpuli (6.1 Kms). Each section will have two rope cars each travelling at a time on opposite directions. The speed of the ropeway will be 12 Kms per hour including the stopover at intermediate points. The journey time per trip will be 1 hour 30 minutes. Assuming that the ropeway will work for 12 hours a day (exclusive of the intervals), the total number of trips that could be made in one direction is estimated as 16. The requirement of electricity to operate the ropeway will be 25 H.P.

Estimated Passenger and Goods Traffic on Proposed Ropeway

The ropeway will carry both passenger and goods. Each carrier will have a capacity of 750 Kgms and will carry 6 passengers and about 300 Kgms of goods at a time. Considering the large quantity of milk to be transported from Mundaneshwar and Kandarpani to Satpuli, it is proposed that at least 4 trips in a day should be reserved for the transportation

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* The technical coefficients used in this study are based on the technical report of the ropeway constructed between Singla Bazar and Darjeeling in West Bengal by the Will Cox Buckwell India Ltd., Calcutta.

of milk between these points. The timing of milk transport should be phased in such a way that it will not fall in the peak passenger traffic period. Leaving aside these four trips for milk transportation the total passenger traffic possible per day is estimated as 1950 (28 x6 x 11.6) passenger kilometres. Assuming the average weight of goods that can be carried along with the passengers as 300 Kgms the goods traffic will be 97.5 tonne kilometres. Adding the four trips proposed exclusively for milk transportation (34.8 tonne Kms) the total goods traffic will be 132.2 tonne kilometres.

Economics of the Proposed Ropeway*

For a length of 11.6 Kms, the cost of construction of the ropeway will be Rs. 40.85 lakhs. In addition, an annual maintenance cost (including electricity) of about 1.2 lakhs will be required.

We have estimated earlier that the number of passenger kilometres per day will be 1950. Assuming that the ropeway will work throughout the year, the total passenger kilometres per year will be 7.1 lakhs. At the rate of 15 paise per kilometre, collection of passenger fare will be Rs. 1,06,500. For goods traffic, a tariff of Re. 1 per tonne kilometre seems to be quite reasonable in this hilly area. For the annual goods traffic of 48,200 tonne kilometres the collection will be Rs. 48,200. The combined collection of passenger and goods fare in a year will be Rs. 1.54 lakhs. Thus, annually there will be a net return of Rs. 34,000 over the recurring cost. It is recommended that the construction cost be paid from the regular PWD budget or from special agency funds.

As the transportation of milk will be an important component in the total goods traffic in the area we estimated the annual transportation cost of milk from Mundaneshwar and Kandarpani to Satpuli. For the movement of 6,000 litres of milk per day during 1979 the annual expenditure will be Rs. 17,400. On the other hand during 1984 when the daily collection is 9,000 litres, the transportation cost will be Rs. 26,100. At this rate the transportation cost per litre of milk will be 2 paise only.

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* The cost of construction of a ropeway of 8.29 Kms. connecting Singla Bazar and Darjeeling in West Bengal was Rs. 29.19 lakhs.

CHAPTER XII

REQUIREMENT OF ELECTRICITY FOR THE DEVELOPMENT OF PAURI TEHSIL

In the preceding chapters we have analyzed the problems and prospects of Pauri tehsil and made several recommendations for the social and economic development of the area. The major hindrance to a balanced development of the area is, of course, its topography which is given and cannot be removed. However, problems which are consequent to the topography such as shortage of water due to heavy run-off, soil erosion and inaccessibility can be overcome with careful planning. The difficult terrain which prevents the use of simple gravity for irrigation and a free and fast movement of people and goods, can be subjugated with the help of power by lifting water to a desired elevation and by running aerial ropeways in areas which would normally defeat any attempt at road construction. Power is expensive, however, and some of these measures may not be economical. Only careful planning can indicate how to use power for productive projects which will bring the maximum return for the investment made.

Our recommendations for the development of the various sectors of the tehsil's economy such as agriculture, horticulture, forestry, sericulture, animal husbandry and transportation are based on the assumption that power would be available for removing some of the primary problems of the area and for utilizing the potentiality of the various sectors for development.

In agriculture, for example, shortage of irrigation water is a major bottleneck. It has been observed that large agricultural areas on the uplands have been left fallow due to lack of irrigation facilities. Even in cultivated lands, inadequate irrigation depresses crop productivity and prevents farmers from growing a second crop. At the present time, large areas are under low-yielding and relatively less remunerative crops like Mandua and Jhangora could have been replaced by more remunerative and popular crops like paddy, wheat and cash crops if irrigation was available. The major reason for the meagre acreage under HYV crops and the negligible application of fertilizers and pesticides is also the same. As has been stated earlier, the topography does not permit a large area to be brought under irrigation by gravity flow and it is beyond one's reach to lift water manually to the extent of 500 feet or so to irrigate one's farm. If possibilities exist for irrigating a large area instead of one or two stray farms, then lift irrigation with power is the ideal solution. Due to the present petroleum crisis in the country, electricity would cost about half of what one would spend on diesel pumps*. We have seen in the chapter of agricultural development that large areas can be irrigated by lift irrigation.

In horticulture, inspite of the favourable agro-climatic conditions, the absence of fruit processing and preservation industries and the lack of an adequate transportation system have prevented the development of this sector in the tehsil. By electrifying the potential industrial centres and by making economical use of aerial ropeways, the isolated orchards can be linked to the market centres, cold storages and processing industries.

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* Mohan Rao, A.L., *Rural Electrification,* Andhra Pradesh State Electricity Board, Hyderabad, 1974 (mimeo).

Animal husbandry, milk chilling, pasteurisation and other allied activities would require a steady supply of electricity.

In the industrial sector, proposed industries such as paper, resin, woollen fabrics, rice and flour mills, etc. cannot be run without electricity.

The objective of this chapter is to evaluate the requirement of electricity in the tehsil during the plan period of 1974 to 1984 under specific heads of consumption namely, domestic, non-domestic, agricultural pumpsets, street lighting and industries. We have also suggested a network of 11 KV transmission lines linking villages of a certain population size, market centres, irrigation projects and industrial areas.

Current Status of Electrification in Pauri Tehsil

The extent of electrification in this hilly tehsil is practically negligible. Out of 1,392 settlements only 18 settlements (3 urban centres, 12 villages and 3 market centres) were electrified up to 1973. Pauri town was electrified in 1957 and was the first settlement in the tehsil to receive power. Srinagar was electrified in 1964 and was followed by Devprayag in 1966 and Rudraprayag in 1969. The remaining 12 villages and 3 market centres were electrified during 1971-72. Thus during 1969-71, no village was electrified. Industrial development in the tehsil also followed the same trend illustrating the very close relationship between power and industrialization. The location of the existing power houses, alignment of transmission lines and the electrified urban centres and villages are shown in Figure XII.1. It can be seen from the Figure that the few villages which are electrified lie along the transmission line connecting Srinagar, Pauri and Bah Bazar. A new line linking Thailisain with the sub-station at Masi has been constructed but no connections have been given to the consumers yet. Barring the above transmission lines which pass through the fringe of the tehsil, a large area with potentiality for development and with a sizeable population is unserved by electricity.

Present Number of Connections and Connected Load

The existing number of connections and connected load under various heads namely, domestic, non-domestic, street lighting and L.T. industries are shown in Table XII.1 The information was supplied to us by the officials of the State Electricity Board in Pauri. Apparently, there are no agricultural pumpsets in the tehsil as no consumption for pumpsets has been shown in Table XII.1.

The percentage of houses electrified in urban and rural areas were 29.6 per cent and 13.25 per cent, respectively. The load per domestic connection was 414 watts in the urban areas and 305 watts in the rural areas. The break-up of load connected under different heads is given in Table XII.2.

From Table XII.2 it can be seen that domestic connections constitute a large percentage (73.60) of the total load. Industrial sector accounts for 10.70 and there is no connected load under the head agricultural pumpsets.

Electrification Policy

The settlement pattern of the study area is a typical case of many hilly areas in our country. A large number of small settlements are scattered all over the area many of which are inaccessible. In such a situation, the transmission lines have to be taken to long distances for comparatively small loads. In addition, the power requirement is limited to a

TABLE XII.1 : PAURI TEHSIL : ELECTRIC CONNECTIONS AND LOAD IN 1973

S. No.	Town/Village	Date of electrification	Domestic Service		Non-domestic Service		Street Lights		L.T. Industries	
			No.	Connected load	No.	Connected load	No.	Connected load	No.	Connected load
1	2	3	4	5	6	7	8	9	10	11
1.	Pauri (urban)	29-5-57	540	178.23	56	58.00	200	8	5	28.00
2.	Srinagar (urban)	20-2-64	325	171.32	16	16.98	37	1.5	1	4 85
3.	Devprayag (urban)	29-3-66	135	77.45	25	2.00	125	5	1	5 50
4.	Rudraprayag	16-8-69	128	40.34	25	14.50	25	1	2	20.5
5.	Khankara	10-6-72	14	4.50	—	—	—	—	—	—
6.	Khandusain	10-8-72	7	2.00	—	—	—	—	—	—
7.	Dang	6-3-72	16	4.45	—	—	—	—	—	—
8.	Srikot	24-11-71	10	3.30	—	—	—	—	—	—
9.	Sweet	24-11-71	9	2.70	—	—	—	—	—	—
10.	Pharasu	29-2-72	6	1.80	—	—	—	—	—	—
11.	Bogani	24-2-72	10	3.3	—	—	—	—	—	—
12.	Kalıasain	10-6-72	1	0.3	—	—	—	—	—	—
13.	Markota	10-10-72	1	0.3	—	—	—	—	—	—
14.	Dinigariparith	10-6-72	1	0.3	—	—	—	—	—	—
15.	Kutan*	27-10-72	Nil	Nil	—	—	—	—	—	—
16.	Molkandi*	27-10-72	Nil	Nil	—	—	—	—	—	—
17.	Ojali*	17-11-72	Nil	Nil	—	—	—	—	—	—
18.	Ufalda*	17-11-72	Nil	Nil	—	—	—	—	—	—

* Although transmission lines have been made available in these villages, no power was actually supplied to them at the time of writing this report.

TABLE XII 2 : PERCENTAGE OF LOAD CONNECTED UNDER DIFFERENT HEADS

S. No.	Type	Percentage Load
1.	Domestic	73.60
2.	Non-domestic	13.40
3.	Street Light	2.30
4.	L.T. industries	10.70

few hours In some cases, power is used for only one activity such as pumping water, domestic use and so on. In the absence of a guideline, this kind of uneven use of electricity will continue at a loss to the Electricity Board. A much more economical way is to look at the functions present in a settlement and give priority to those villages which have a number of interrelated functions. Thus electricity supplied to a place can be used not only for lift irrigation but also for industries, cold storage or even for hospitals and educational institutions.

In the light of the above discussion, the following policies for electrification in the tehsil are suggested.

1. All growth centres, service centres and central villages (if they are not already electrified) and villages of 200 population or more should get top priority in the electrification programme.*
2. Irrigation projects which are geographically close and form a cluster will require shorter lengths of transmission lines. These clusters should be taken up in the first phase of the plan (1974-79) and the remaining projects during the second phase (1979-84).
3. All settlements within a population range of 50-200 and situated near transmission lines originally meant for places mentioned in (1) and (2) above should be electrified.
4. In addition, all settlements in which power-operated industries have been recommended, regardless of their population size or status, should be electrified.
5. Centres where hospitals, colleges, schools and other similar institutions have been proposed and if they have not already been covered by items (1)—(4) above, should be electrified. However, the priority, if there has to be one, of these centres should be next to those recommended in item (4).

Projected Number of Connections and Power Load

In view of the above policies, settlements which qualify for electrification have been identified. The next task was to estimate the possible number of connections and the power load. The techniques for the projection of power requirement under various heads, and the norms used are as follows.

Domestic. In determining the future domestic connections and power requirement, a simple method was followed. For centres already electrified, it was assumed that the

* According to the norm suggested by the Planning Commission, 30 to 40 per cent of the rural population in the country should be covered by rural electrification programmes by the end of the Fifth Plan. About 25 per cent of the rural population in Pauri tehsil lives in villages of 200 people or more. Our recommendation suggests a lower coverage than the Planning Commission norm because of the difficult physical problems of the area. We recommend a higher coverage, 30 per cent during 1979-84.

past trend in the rate of electrification will continue. Our analysis shows that in the electrified areas, there will be an annual increase of 2.5 per cent in domestic connections. In the absence of past data on domestic connections for each centre, the percentage increase was calculated by ranking the electrified centres according to their date of electrification. The number of connections were divided by the estimated total number of houses to get such an increase year by year. The date of electrification and the proportion of houses electrified in various centres are shown in Table XII.3.

TABLE XII.3 : PERCENTAGE OF HOUSES ELECTRIFIED IN 1973

S No.	Name of Town/Village	Date of electrification	Percentage of houses electrified
1.	Pauri	1956	29.7
2.	Srinagar	1964	28.6
3.	Deoprayag	1966	26 4
4.	Rudraprayag	1969	20.4
5.	Srikot	1971	15.3
6.	Dang, Sweet, Pharasu, Bogani, Kaliasain, Narkota and Dunigari*	1972	13.2

* As all 7 villages were electrified in the same year, the average percentage for all 7 villages has been shown.

At the above rate, the number of new domestic connections in already electrified settlements will be 12.5 per cent of the total number of houses in 1979.

In settlements which will be newly electrified by 1979, at least 20 per cent of the households will have electricity. This estimate, slightly higher than the present rate of 13.25 per cent is based on the assumption that economic condition will improve in the area. Based on the existing connected load per household, an average of 0.03 KW per domestic connection in the rural areas and 0.04 KW in the urban areas and other central places were assumed to estimate the total power requirement in 1979. The same procedure and norms were used to estimate the number of connections and connected load during 1984 also. The estimated number of domestic connections and connected load during 1979 and 1984 are shown in Tables XII.4 and XII.5.

Non-domestic. For projecting power load for non-domestic use, the centrality score of a settlement based on the presence or absence of central functions was used.* A ratio of this score and the load in (KWs) was worked out. The ratio between the centrality of a settlement and its non-domestic load was 0.358. The same ratio was used to calculate the power requirement under non-domestic head during 1979 and 1984.** The scalogram scores of centrality for various centres in 1979 and 1984 were projected by adding the proposed functions in each centre to the score for 1973. The estimated total connected load under this head are 490 KW and 980 KW, respectively, during 1979 and 1984.

* For a detailed account of the scoring technique based on scalogram analysis, see chapter IV of this report.

** The ratio was doubled for growth centres as many retail functions outside of our recommendations are likely to emerge in these centres due to the many development inputs proposed.

TABLE XII.4 : ESTIMATED REQUIREMENT OF POWER IN PAURI TEHSIL—1979

S. No.	Name of the Cluster	Domestic		Non-domestic connected load	Street lights		Lift irrigation Pumpsets connected load	Industries	
		No.	Connected load		No.	Connected load		No.	Connected load
1	2	3	4	5	6	7	8	9	10
1.	Bahbazar	223	111.55	17 90	152	6 08	313.19	2	14 92
2.	Ghindwara	48	14.40	1.79	23	0.92	938.34	1	3 73
3.	Baganikhal	40	12.60	1.61	20	0.80	387.76	1	3.73
4.	Diusi	17	6.80	1 79	15	0.60	436.23	—	—
5.	Ghandiyal	36	11.90	4.48	44	1.76	454.88	3	111 19
6.	Kanskhet	48	14.40	5 91	49	1.96	227.44	2	14.92
7.	Nahsain	32	9.60	5.37	51	2.04	555 55	1	3.73
8.	Safdarkhal	49	14.70	5.38	48	1.92	—	1	3.73
9.	Kamalpur	56	16.80	3 58	29	1.16	316 92	1	3.73
10.	Jamlakhal	52	15.60	2.87	28	1.12	1163.29	1	3 73
11.	Delchaunri	129	38.70	2 33	41	1.64	339.29	1	3.73
12.	Khandisain	74	22.20	3.77	40	1.60	197.61	1	3.73
13.	Kot	87	30.00	8.06	55	2.20	510.80	2	11.19
14.	Khelachaunri	72	21.60	2.69	28	1.12	227.44	1	3.73
15.	Lwali	69	21.40	4.11	31	1.24	134.23	1	3.73

TABLE XII.4 : (*Contd.*).

1	2	3	4	5	6	7	8	9	10
16.	Adhwani	43	12.90	5.19	32	1.28	164 05	1	57 60
17.	Kaljikhal	54	16.20	4.65	48	1.92	178 97	1	3 73
18.	Saknikhet	33	9.90	2.33	22	0.88	283.37	—	—
19.	Banghat	47	14.10	3.05	21	0.84	264.72	1	3 73
20.	Satpuli	25	7.50	50.54	108	4.32	253.54	7	1806 77*
21.	Kandarpani	49	14.70	2.33	29	1.16	283.37	2	69 73
22.	Mawadhar	3	0.90	2.50	22	0.88	—	1	22.43*
23.	Patisain	21	6.30	5.37	47	1.88	—	—	—
24.	Mundneshwar	66	19.80	3.76	29	1.16	—	2	36.73
25.	Pipalpani	18	5.40	2.15	22	0.88	—	1	3.73
26.	Jakheti	35	10.50	1.97	29	1.16	227 44	1	3.73
27.	Agrora	32	9.60	3.43	24	0 96	227 44	—	—
28.	Paidul	96	31.50	6.08	55	2.20	182.70	—	—
29.	Parsundakhal	108	32.40	7.88	66	2 64	272.18	4	68 65
30.	Kandara	58	18.70	2.87	23	0.92	—	—	—
31.	Bubakhal	55	16.50	5.19	48	1 92	—	1	3 73
32.	Dauduadevi	6	1.80	1.79	16	0.64	205.07	—	—
33.	Pauri	873	305.43	60.72	260	10.40	477.25	9	83 22

TABLE XII 4 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10
34.	Kyark	51	17.60	2.51	20	0 80	227.44	1	3.73
35.	Kirtinagar	21	6.30	6.63	49	1.96	—	1	7.46
36.	Srinagar	579	263 47	28.99	129	5 16	596.56	5	37 30
37.	Sumari	140	45 00	5.19	40	1.60	216 25	1	3.73
38.	Chaubatiakhal	84	25.20	5 01	53	2 12	—	1	3.73
39.	Choprium	57	19 80	3 58	18	0.72	171.51	—	—
40.	Bhainswara	93	35.60	0 36	3	0 12	—	1	3.73
41.	Sikukhal	87	29 60	3.57	20	0.80	—	1	3.73
42.	Pokhrikhet	75	22.50	7 34	55	2.20	339.29	1	3.73
43.	Champeshwar	110	33.00	5.55	35	1.40	328 11	1	3.73
44.	Pabau	139	43.80	7.87	70	2.80	261 00	1	3 73
45.	Khirsu	142	42.60	12.17	114	4.56	—	34	282 38
46.	Kherkhal	98	29.40	2.55	35	1.40	—	1	3.73
47.	Bhattisera	51	15 30	4.84	50	2.00	171.51	2	7.46
48.	Mailisain	60	18.00	3 22	25	1.00	171.51	1	3.73
49.	Chifalghat	62	18.60	6 62	59	2.36	227.44	1	3.73
50.	Sankarsain	46	13.80	1.61	21	0 84	227.44	—	—
51.	Cholusain	61	18.30	2 33	24	0.96	171.51	1	3.73

TABLE XII.4 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10
52.	Bajwar	55	18.50	1.80	13	0.52	—	—	—
53.	Damdeval	78	23.40	4.65	33	1.22	171.51	1	3.73
54.	Chaundrikhal	—	—	3.22	13	0.52	—	—	—
55.	Pokhri	34	13.60	1.79	7	0.28	—	—	—
56.	Bhira	45	13.50	6.09	45	1.80	—	2	11.19
57.	Thailisain	137	41.10	40.50	81	3.24	510.80	11	349.89
58.	Nautha	96	28.80	2.32	22	0.88	—	1	3.73
59.	Chakisain	54	16.20	4.30	39	1.56	171.51	2	11.19
60.	Paithani	80	25.60	1.61	23	0.92	227.44	1	3.73
61.	Barsuri	92	29.60	3.04	28	1.12	—	1	3 73
62.	Rudraprayag	216	72.54	43.04	139	5.56	111.86	33	278.65
63.	Khankara	37	13.87	2.69	24	0.96	227.44	—	—
64.	Sumerpur	10	4.00	1.25	10	0.40	—	—	—
65.	Ratura	68	27.20	3.04	8	0.32	171.51	1	3.73
66.	Molkakhal	56	16.80	4.30	40	1.60	—	1	3.73
67.	Cidokhal	—	—	—	—	—	—	—	—
68.	Chaunra	141	43.30	3.94	33	1.32	283.37	1	3.73
69.	Gadoli	107	33 60	2.69	32	1.28	227.44	—	—
70.	Tarpali	36	12.60	1.61	15	0.60	111.86	1	3.73
71.	Bungidhar	100	30.00	5.02	41	1.64	227.44	2	7.46
72.	Samoya	34	10.50	1.79	21	0.84	171.51	1	3.73
	Total	6086	2068.96	492.09	3042	121.68	14762.15	165	3587.41

* Connected load includes 18.7 KW for proposed Ropeways.

TABLE XII.5 : ESTIMATED REQUIREMENT OF POWER IN PAURI TEHSIL—1984

S. No.	Name of the Cluster	Domestic		Non-domestic connected load	Street lights		Lift irrigation pumpsets connected loads	Industries	
		No.	Connected load		No.	Connected load		No.	Connected loads
1	2	3	4	5	6	7	8	9	10
1.	Bahbazar	346	157.75	42.24	186	7.44	313.19	2	14.92
2.	Ghindwara	128	38.40	4.30	32	1.28	1905.26	1	3.73
3.	Baganikhal	99	30.60	3.94	26	1.04	1126.01	1	3.73
4.	Diusi	42	15.00	3.58	19	0.76	436.23	1	3.73
5.	Ghandiyal	84	26.80	9 31	49	1.96	853.83	3	163 19
6.	Kanskhet	94	28.20	12 53	59	2 36	510.80	2	14.92
7.	Nahsain	102	30 60	11.46	62	2 48	1405 64	1	3.73
8.	Safdarkhal	146	43.80	10.75	62	2 48	227.44	1	3.73
9.	Kamalpur	102	30.60	7.52	38	1.52	678 59	1	3.73
10.	Jamlakhal	112	33 60	6 08	38	1.52	1312 43	1	3 73
11.	Delchaunri	215	64 50	5.01	42	1.68	678 59	2	7.46
12.	Khandisain	130	39.00	7.52	44	1.76	309 47	1	3.73
13.	Kot	193	63.50	21.14	92	3.68	999 24	2	11.19
14.	Khelachaunri	116	34.80	5 37	33	1.32	454.88	1	3.73
15.	Lwali	145	44.50	8.22	43	1.72	451.15	1	3.73

TABLE XII.5 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10
16.	Adhwani	89	26.70	10.36	48	1.92	275.91	1	82.50
17.	Kaljkhal	113	33.90	9.31	51	2.04	589.10	1	3.73
18.	Saknikhet	60	18.00	3.66	26	1 04	622.66	—	—
19.	Banghat	109	32.70	6 08	34	1 36	518.26	1	3.73
20.	Satpuli	64	19.20	103 16	168	6.72	253 54	9	2759 67*
21.	Kandarpani	103	30.90	5.37	35	1 40	566.73	2	103 73
22.	Mawadhar	32	9.60	5.01	26	1.04	850.10	1	22.43
23.	Patisain	56	16.80	12.90	56	2 24	—	—	—
24.	Mundneshwar	145	43.50	7.88	44	1.76	339 29	2	53 23
25.	Pipalpani	50	15.00	4.65	26	1.04	—	1	3 73
26.	Jakheti	79	23.70	3.94	45	1.80	227 44	1	3.73
27.	Agrora	80	24.00	10.02	46	1.84	227.44	1	3.73
28.	Paidul	154	50.10	12.16	58	2.32	637.57	—	—
29.	Parsundakhal	189	56.70	16.11	76	3.04	727.06	4	68.65
30.	Kandara	94	30.10	6.08	27	1.08	—	1	3.73
31.	Bubakhal	91	27.30	10.38	48	1.92	—	—	—
32.	Daduadevi	21	6.30	3.94	20	0.80	205.07	—	—
33.	Pauri	1278	459.93	128.88	324	12.96	1043.98	10	164 62

TABLE XII.5: *(Contd.)*

1	2	3	4	5	6	7	8	9	10
34.	Kyark	103	32.10	5.38	29	1.16	738.24	1	3.73
35.	Kirtinagar	35	10.50	13.62	57	2.28	—	1	7.46
36.	Srinagar	833	361.42	62.24	210	8.40	1088 72	6	41.03
37.	Sumari	236	70.80	11.09	63	2.52	372.85	2	7.46
38.	Chaubatiakhal	154	46.20	12.71	72	2.88	—	1	3.73
39.	Choprium	128	42.30	7.52	42	1.68	454.88	—	—
40.	Bhainswara	141	53.40	0 72	6	0.24	—	1	3.73
41.	Sikukhal	137	46.20	7.14	36	1.44	—	1	3.73
42.	Pokhrikhet	202	60.60	15.74	79	3.16	749 43	2	11 19
43.	Champeshwar	204	61.20	11.47	57	2.28	950 77	1	3 73
44.	Pabau	250	78.10	16.47	85	3.40	261.00	1	3 73
45.	Khirsu	244	73.20	35.44	164	6 56	—	64	547.14
46.	Kherkhal	90	27.00	10.74	55	2.20	454.88	3	14 92
47.	Bhattisera	226	67.80	5.37	45	1 80	272 18	1	3.73
48.	Mailisain	142	42.60	6.44	38	1 52	715 87	1	3.73
49.	Chifalghat	95	28.50	13.90	65	2.60	227 44	2	11 19
50.	Sankarsain	88	26.40	3.94	26	1.04	622.66	1	3.73
51.	Cholusain	103	30.90	5.02	29	1.16	398.95	1	3 73

TABLE XII.5 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10
52.	Bajwar	88	29.30	4.95	20	0.90	—	—	—
53.	Damdeval	131	39.30	9.66	45	1.80	398 95	1	3.73
54.	Chaundrikhal	—	—	—	15	0.60	—	—	—
55.	Pokhri	55	21.40	3.58	16	0 64	—	—	—
56.	Bhira	86	25.80	12.18	55	2 20	—	2	11 19
57.	Thailisain	268	80.40	18.63	94	3.76	1830.69	11	489.89
58.	Nautha	183	54.90	5.00	32	1.28	283.37	1	3.73
59.	Chakisain	103	30.90	8.95	46	1.84	343.02	2	11.19
60.	Paithani	136	43.10	3.58	24	0.96	622.66	1	3.73
61.	Barsuri	193	60.80	6 45	42	1.68	—	2	7.46
62.	Rudraprayag	328	113.14	85.92	188	7.52	451 15	63	538.65
63.	Khankara	68	23.20	5.37	28	1 12	227.44	—	—
64.	Sumerpur	14	5.60	2.86	12	0.48	—	—	—
65.	Ratura	114	44.00	6 08	18	0 72	398 95	1	3.73
66.	Molkakhal	102	30.60	8.59	43	1 72	—	1	3.73
67.	Gidokhal	—	—	—	—	—	—	—	—
68.	Chaunra	245	75.00	8.24	47	1.88	425.05	1	3 73
69.	Gadoli	175	54.70	6.09	37	1 48	566 73	—	—
70.	Tarpali	68	23.00	3.22	18	0.72	111.86	1	3.73
71.	Bungidhar	216	64.80	11.45	61	2.44	454.88	2	7.46
72.	Samoya	51	17.60	3.58	21	0.84	343.02	1	3.73
	Total	11802	3602.84	978 19	4003	160.12	32512.54	236	5299.56

* Connected Load includes 18.7 kw for proposed Ropeways.

Street Lights. As in the case of non-domestic loads, the ratio between the centrality score of a settlement and its corresponding load (1973) for street lights was worked out. The ratio was 0.0613. The same ratio was used to compute the power load according to the estimated centrality score in 1979 and 1984 with the exception of growth centres where it was doubled. In few villages where no functions were recommended but were proposed for electrification, at least two street lights should be connected if the population is above 200, and only one connection for settlements below this population level. Each street light is proposed to have a power of 0.04 KW. The total estimated loads under this category are 120 KWs and 160 KWs during 1979 and 1984, respectively.

It should be pointed out in this connection that the responsibility of providing street lights in the Panchayat/Town areas is vested with the local administrative authorities and the number of street lights that will be provided in their jurisdiction is a matter of policy and financial capability. Hence it is often difficult to predict exactly how many street lights will be provided during the plan period. What we have suggested is the bare minimum.

Agricultural Pumpsets. The estimation of the capacity of pumpsets is based on two factors namely, the peak requirement of water for different crops and the 'head' to be lifted in the particular areas. The locations of proposed irrigation areas are shown in Figure V.6 in chapter V. The estimation of water requirement for various crops, irrigation intervals and the methodology used to estimate the break horse power are described in Chapter V. The cluster-wise loads in 1979 and 1984 under this item are shown in Tables XII.4 and XII.5.

Industries. In the chapter on industrial development, we have highlighted the need for electricity in the resource areas without which it will be impossible to introduce industries for the development of these resources. Our industrial proposals have been guided by the assumption that all the central villages except Gidokhal (the electrification of this centre requires the extension of power line to a length of about 20 kms) will be electrified during the ten-year plan period. In addition to a large number of small-scale L.T. industries, we have proposed major industries such as a paper mill, a woollen textile mill, a milk pasteurisation plant and cold storages which are bulk consumers of power. The norms used for estimating the requirement of electricity for various industries are listed below.

TABLE XII.6 : NORMS FOR ESTIMATING POWER REQUIREMENT OF INDUSTRIES*

S.No.	Type of Industry	Capacity		Power in KW
1	2	3		4
1.	Rice Mill	2	tonnes per day	7.46
2.	Flour Mill	1	,,	3.73
3.	Paper, Newsprint	20	,,	1,000.00
4.	Rosin	3	,,	7.46
5.	Saw Mill	3	,,	7.46
6.	Wood-based furniture	20	workers	20.00
7.	Spinning unit	100	basin	10.00

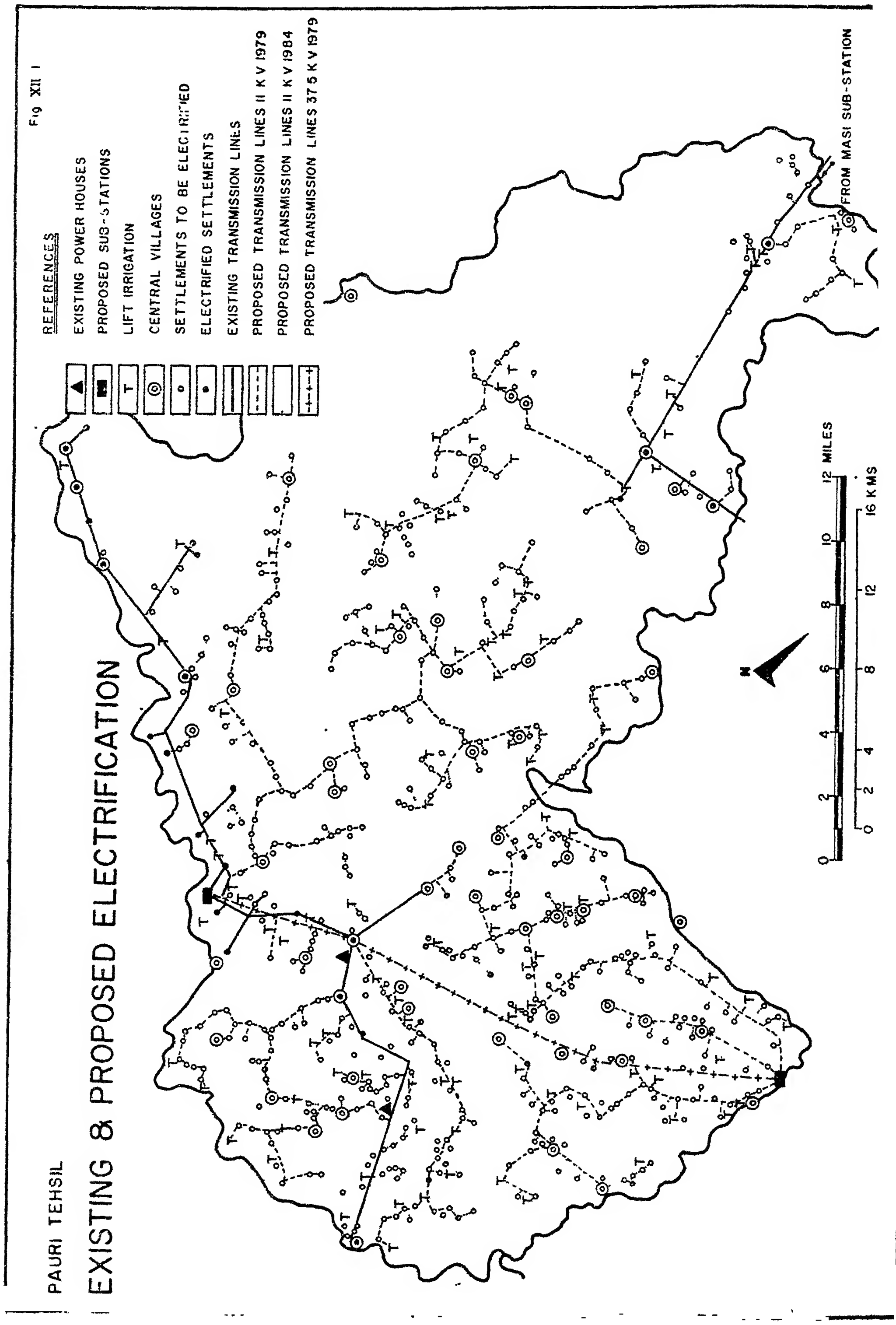
Fig XII 1
REFERENCES
EXISTING POWER HOUSES
PROPOSED SUB-STATIONS
LIFT IRRIGATION
CENTRAL VILLAGES
SETTLEMENTS TO BE ELECTRIFIED
ELECTRIFIED SETTLEMENTS
EXISTING TRANSMISSION LINES
PROPOSED TRANSMISSION LINES 11 K V 1979
PROPOSED TRANSMISSION LINES 11 K V 1984
PROPOSED TRANSMISSION LINES 37 5 K V 1979
PAURI TEHSIL
EXISTING & PROPOSED ELECTRIFICATION
FROM MASI SUB-STATION
0 2 4 6 8 10 12 MILES
0 2 4 8 12 16 KMS

as welfare were kept in mind. To make the electrification programme remunerative, we have adopted cluster schemes on the basis of extending power to contiguous or several small areas with large population size, and catering to the needs of agricultural pumpsets, agro-industries and other L.T. industries in the area. The proposed transmission line is also based on the assumption that the sub-stations as proposed by the Uttar Pradesh State Electricity Board at Satpuli, Srinagar and at Masi (Lansdowne tehsil) will be installed according to schedule.* However, our study has lead us to the conclusion that the load requirement in the tehsil during the plan period will surpass the proposed capacity** of the sub-stations. The estimated total load in the tehsil during 1979 and 1984 are 21,030 and 42,550 KWs, respectively.

The proposals made for the alignment of transmission lines herein have been coordinated with the proposals of the Uttar Pradesh State Electricity Board as far as possible. However, in some cases our recommendations differ from the plan of the U.P.S.E.B. We can only say that the electrification plan presented in this report is formulated as a part of an integrated development programme and is based on the demand from various sectors and areas.

As regards the capacity of the transformer centres, the actual demand of power load at the take-off point from the main line has to be estimated. The transformer centres can be provided with standard capacity units of 15 KVA, 25 KVA and 63 KVA. The transformer will be mounted on double pole structures of standard design.

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* It may be noted that some of the recommendations of the U.P.S.E.B. have been incorporated in this chapter. For example, the sub-stations at Srinagar and Satpuli are proposed to be linked to the power house by a 37.5 KV transmission line.

** The Uttar Pradesh State Electricity Board has proposed 3 sub-stations of 1.5 MVA each at Lansdowne, Satpuli and Srinagar.

CHAPTER XIII

SUMMARY AND CONCLUSIONS

The study reported in this volume examines the problems of a backward hill area and recommends an integrated plan for its development. The area studied is the tehsil of Pauri in the Pauri-Garhwal district of Uttar Pradesh. The study was sponsored by the Rural Electrification Corporation and its immediate purpose was to examine the extent to which rural electrification can contribute to the development of a backward area of this nature.

The future role of electrification in this area has been viewed in this study within the framework of an integrated area development plan in which other development inputs such as water management, soil conservation, transportation, marketing, storage and industries have complementary roles to play. It has been emphasized in this study that a balanced development of Pauri tehsil will depend on the integration of all of these sectors and that investments will have to be made in these sectors on a time plan along with the investment in electrification.

The best way to integrate and coordinate these activities is to start with the needs and problems of the area in question. A routine application of departmental schemes irrespective of the needs of the area and uncoordinated with the schemes of other departments will not bring about a balanced development of the area.

This study looks at the problem from the point of view of the area itself instead of from the point of view of the standard departmental schemes. The integration of schemes will be fruitful if the programmes emanate from the needs of the area rather than from schematic budgets formulated at the state and national levels.

Broadly, recommendations have been made in this report for the development of the following sectors : agriculture, horticulture, forestry, sericulture, animal husbandry, industries, transportation and electricity. Once implemented, these programmes will bring about an integrated development of all of these sectors. Specific proposals for development have been made for the periods 1974-79 and 1979-84.

For an effective and balanced development of the area, the plan envisages mainly two types of integration in this overall strategy. First, the functional integration of the various sectors such as agriculture, horticulture, forestry, industries, social facilities and so on has been suggested in this report by making use of a spatial model in which development in one sector opens up possibilities for the development in another.

Secondly, existing and potential urban centres have been utilised in this plan for the development of rural areas. The existing hierarchic linkages between villages and towns based on their service relations have been used in this report for optimum use of new investments as well as for decentralization of development activities down to the grassroots level.

The spatial model used for these two levels of integration is based on carefully selected basic units of planning at various hierarchic levels. The optimum locations for various orders of investments in agriculture, horticulture, forestry, industry, social facilities and so on are provided by growth centres, service centres and central villages which are the central places in these planning units.

The tehsil is a typical example of a backward hill area and has been neglected for years due to its own inherent physical constraints among other reasons. Out of many deficiencies in this area, the three most crucial ones are the absence of a well-coordinated and efficient water management system, the lack of accessibility and the severe pressure of population on the limited amount of land available. All of these deficiencies emanate from the basic topographic characteristics of the area which, unfortunately, is given and cannot be changed. Any plan formulated for the development of this area must take this basic limitation into account.

Although the tehsil receives one of the heaviest rainfalls in the country, due to the total absence of a well-coordinated water management policy, the area suffers from serious problems of soil erosion and paradoxically, water shortage. Because of the steep slopes, the run off of water is very heavy. It flows down to rivers which are too deep to be of any use for agriculture except in the valley areas on both sides of rivers Alakananda and Nayar. There are innumerable mountain streams and springs which provide nominal irrigation and drinking water in some areas. A major portion of this water resource goes waste. In our recommendations for the development of agriculture, horticulture, etc. we have given emphasis to a better water management policy and recommended specific proposals for soil conservation.

Inaccessibility is a direct result of the difficult topographic conditions of the area and it is impossible to connect all settlements with each other by road because of the heavy cost involved. Given these limitations, one has to be extremely selective in recommending road connections in this area. Our recommendations on new roads are the barest minimum for the development of the area. Briefly, we have recommended road connections to resource areas which are totally inaccessible to the outside world at the present time. We have also recommended road connections to link villages with market centres. Growth centres, service centres and central villages have also been proposed to be connected with their hinterland villages. In one of the most difficult areas where the cost of the road connection would be prohibitive, we have recommended a small ropeway for opening up an area with rich potential resources. The technical feasibility of the ropeway has been examined and recommendations have been made on the basis of practicability of this particular transportation linkage.

The pressure of population on land is due again to the topography of the area. Most of the land areas which could possibly be brought under cultivation under the present circumstances, are already being cultivated. As the arable area remains limited, the growth of population increases the pressure on land. Overcultivation of land particularly on the slopes have added to the soil erosion of the area. Before making recommendations for easing the situation, we have looked at the existing land-use pattern of the area. With the help of a few techniques, we have identified new areas which could be brought under agriculture without-affecting the growth of other sectors such as horticulture, forestry, animal husbandry and so on.

We have also examined the irrigation potentiality of the area and have recommended several lift irrigation projects by which water which is now going waste can be lifted to the desired level and distributed to areas which are currently unirrigated. The combination of additional acreage of land for cultivation and the irrigation projects would provide a large area of land for agriculture.

The area is deficit in agricultural production. A large volume of food articles have to be imported from outside the tehsil and the district for subsistence. Projections of agricul-

tural production based on the extended areas under new irrigation show that the deficit can be reduced to a great extent by 1979. By 1984, a marginal surplus is possible.

Potentially the most important natural resource of the area are the forests which cover 56 per cent of the total geographical area and contain many varieties of trees with commercial and industrial possibilities. Full economic utilization of these rich forests has yet to be made. On the contrary, illegal cutting of firewood and indiscriminate grazing are denuding the forests resulting in more soil erosion and depletion of a valuable natural wealth.

In horticulture, we find the repetition of the same story. Although the climate, altitude, slopes and rainfall are all ideally suited for horticultural development, very little advantage of these has been taken by the local people for growing fruit trees.

In animal husbandry, the problem is again of the limited amount of grazing land. There are a few community forests which have been traditionally used for grazing of cattle, sheep and goats. But these areas also suffer from serious problems of soil erosion because of unrestricted lopping and grazing.

Our recommendations are based primarily on better land-use practices. As in the case of agricultural land, extension of land under forests, fruit trees and community forests have also been found feasible.

At the present time, the area presents a picture of extreme backwardness and poverty existing side by side with vast natural resources and manpower which have remained unharnessed over the years. Left to itself, the area will remain backward and may even slide further back due to the unique set of interlocking problems mentioned above. Water conservation, soil conservation, road linkages and better land-use practices should receive priority in any planned effort for developing this area. With the improvement in agriculture, the economic base of area should be diversified into commercial horticulture, animal husbandry, forestry, sericulture and other allied activities. In the long run, these sectors, and not agriculture, will provide a strong base for the future prosperity of the area. At the present time, one cannot ignore agriculture as it employs about 84 per cent of the total working force of the tehsil. A good proportion of this manpower will have to be slowly moved over to alternative and more profitable activities as some of the basic problems of the area are removed.

The most important strategy followed in this study for the formulation of an integrated plan for the tehsil, is the spatial integration of the various sectors. The location of new activities have been proposed on the basis of the existing and future linkages between urban centres in the study area, growth centres, service centres, central villages and their hinterlands. In the plan, these centres have been utilized for introducing changes into the rural areas through new development programmes.

Summary of Findings and Recommendations

Identification of Growth Centres, Service Centres, Central Villages and their Hinterlands. The various central places in the tehsil were identified according to their level of centrality, size of their hinterlands and the size of the population served. The centres were identified at three levels and were labelled as central villages, service centres and growth centres. The hinterlands of the central villages (the lowest level centres) were used for the purpose of estimating and projecting the needs and potentialities of agriculture, horticulture, forestry, sericulture and animal husbandry. The service centres and growth centres and their hinterlands were utilised for estimating the needs and potentialities of the area with reference

to higher order functions such as large industries, cold storage, wholesale markets, etc. The centres were identified partly by mapping out people's actual movements seeking different orders of service and functions, and partly with the help of a mathematical technique measuring the degree of functional complexity present in each of these centres. The hinterlands of these centres were delineated again partly with the help of information on people's movements and partly with the help of a mathematical model. The model was suitably modified for a better fit in an area with difficult topological conditions.

In all, six growth centres, 25 service centres and 72 central villages were identified. The service centres provide central village functions, as well as their own. Similarly, growth centres provide, in addition to their own, functions normally offered by service centres and central villages.

Of the six growth centres, Pauri, Srinagar and Bahbazar are already classified as urban in the 1971 census report. The remaining three, Thailisain, Rudraprayag and Satpuli show strong trends of growth.

Thailisain is in the centre of a very large forest and hill area in the eastern part of the tehsil. Although as a growth centre, the number of functions present in Thailisain is small (26) and even smaller number of highest level functions (5), it commands a population which comes next only to Pauri and Srinagar. The size of the hinterland of Thailisain is next only to Pauri. Because of the geographical importance of Thailisain and its potentiality, several functions, services and industries have been proposed in this centre. If implemented, the recommended functions will remove the present deficiencies of Thailisain and will also accelerate its growth to become fullfledged town during the next few decades. Thailisain has the potentiality of becoming a tehsil headquarters if the Government of Uttar Pradesh decides to create a third tehsil in the district of Pauri Garhwal in the western part of the district covering most of the forest and hill areas.

Rudraprayag is the smallest of the growth centres in terms of the population and area of its hinterland. However, it has a larger number of functions (51) than Thailisain and a larger number of functions of the highest order (21). Rudraprayag's importance lies in its strategic location on the century-old pilgrim route from Haridwar to Kedarnath and Badrinath. Over the years, a number of important and central functions have gravitated towards this centre due to its very large seasonal population and commercial importance.

Satpuli, the remaining non-urban centre proposed as a growth centre, lies just outside the tehsil borders in the south. Satpuli has 53 functions of which 22 belong to the highest level. It also serves a large population and area of the tehsil in addition to its hinterland in Lansdowne tehsil. From the point of view of geographical centrality, communications, availability of suitable flat land and nearness to important sources of water supply, Satpuli is potentially the most important centre in the hill district. Although at the present time, it is not even classified as an urban centre, its potentiality is definitely of the highest order. The location of Satpuli at the confluence of the east and west Nayar rivers in addition to its location on the Kotdwara-Srinagar main road, makes it an ideal site for heavy industries and a very large commercial centre for storing and distributing food and commercial raw materials.

The growth centres which are already classified as urban are, Pauri, Srinagar and Bahbazar. Pauri is already the headquarters for the division, the district and also the tehsil and appropriately has the largest population base in its hinterland. With the largest number of both total functions (71) and highest order functions (36), it will continue functioning as a centre of major importance administratively, commercially as well as culturally.

Srinagar with 69 functions of which 35 belong to the highest level is also on the pilgrim route to Kedarnath and Badrinath and has a large commercial centre. The bridge over Alaknanda connects Srinagar with the main motorable road in Tehri-Garhwal connecting Haridwar.

As the eastern continuation of Devprayag town is separated from it by river Alaknanda, Bahbazar's future will naturally be linked with the development of Devprayag. The new road, currently under construction, which will connect it with Pauri town, will increase its importance as a commercial centre. Much of the traffic which goes to Pauri *via* Srinagar will be short circuited this way.

Agriculture. About 84 per cent of the working force of Pauri tehsil depends on 20 per cent of the total geographical area for subsistence. This illustrates two major problems of the area, the limited amount of arable land available for cultivation under the present conditions and the lack of alternative employment opportunities. The purpose of our analysis was to carefully examine the agricultural potentiality of the area in order to make recommendations for its improvement. It was observed that a large additional area can be brought under cultivation if irrigation water can be made available with the help of a proper water management system.

With one of the heaviest rainfalls in the country and with the presence of major rivers and innumerable mountain streams and springs, the area still suffers from a shortage of water supply. The steep slopes increase the run-off of water creating serious soil erosion. The run-off water flows down into the rivers without being utilised. The rivers are in most places too deep to be of any use to the people. Except in the valleys, river water cannot be used for irrigation. However, a careful analysis indicated that with lift irrigation schemes, about 11,000 hectares can be brought under irrigation.

The potential areas which can be brought under cultivation were identified with the help of cartographic techniques. Properties of the land which are unfavourable for agriculture were mapped and by process of elimination, areas suitable for agriculture were marked off. It was estimated that 29,300 hectares in addition to the existing agricultural land could be brought under agriculture. In other words, the present 20 per cent net sown area can be increased to about 33 per cent. However, this increase will be possible *only* if proper soil conservation measures are adopted, irrigation water and other important agricultural inputs are made available to the farmers.

A comparison of the existing food supply and consumption was made. The analysis showed that there is a deficit in the two major food crops, rice and wheat of the order of 10,000 tonnes each. If the proposed agricultural land is brought under cultivation with the help of irrigation water and if improved management practices are introduced, it was estimated that by 1979 the deficit in rice and wheat can be reduced by about half. In 1984 there will even be a marginal surplus of these two crops.

It was recommended that along with reclaiming potential agricultural land and initiating irrigation projects, several preventive and curative measures to solve some of the existing problems should be taken up simultaneously. Some of these measures are : soil conservation, provision of agricultural inputs, storage, marketing and an adequate transport system. Without doubt, these measures will require heavy investments on the part of the government as the problems of this area have remained neglected for a long time. The question of cost-benefit of investment in agriculture has been discussed in this report. The alternative of letting agriculture remain as it is and divert the investments in alternative economic activities

such as horticulture, forestry, sericulture, animal husbandry has also been examined. The food deficit in that case will have to be met from very large supplies from outside. We have concluded that as the most realistic and practical solution, both agriculture and other alternative economic activities should be developed simultaneously. The very large proportion of the working force which is now engaged in agriculture cannot be moved to other activities within a short period of time. Secondly, the rugged and inhospitable terrain of the area makes it extremely difficult to organize an efficient distribution system in the tehsil. The heavy transport cost will have to be borne either by the people of area or by the government. It is better economics to make the area at least self-sufficient in food crops. The heavy initial investments will not only benefit agriculture but other activities also. Soil conservation methods, for example, will be beneficial for horticulture and forestry as much as they will be for agriculture. In addition, there is an important psychological factor which will prevent a quick change over. In a situation of scarcity, any new venture carries a certain amount of financial risk. Psychologically, people are more used to agriculture even if it is not profitable. They will rather depend on something which will require minimum investment and minimum risk than venturing into something that is unknown to them. Moreover, some of the other alternatives such as horticulture requires a long waiting period before the investment is paid back. Resources especially in the form of cash is not readily available in the area for a long unremunerative waiting period. These are some of the reasons why investments in agriculture have been recommended in this report along with investments in horticulture, forestry, sericulture and animal husbandry. On the other hand, there is no doubt that the future prosperity of the tehsil depends really on these activities than on agriculture. The change over to these activities from agriculture should be gradual. For a period of ten years at least, investments will have to be made in agriculture along with investments in horticulture, forestry, sericulture and animal husbandry.

Agricultural Infrastructure. Agricultural development in Pauri tehsil will depend on three sets of interlinked problems. Land development, soil conservation and irrigation must precede other programmes for agricultural development. Inputs such as fertilizers, improved seeds, pesticides and credit should be made available to the farmers once the land has been made ready for cultivation. Institutions distributing these inputs must be evenly spread over the tehsil so that they can be easily reached by as many farmers as possible. After harvesting, the problems of storage, marketing and transportation will have to be solved.

Planning for an agricultural infrastructure basically involves two operations. In the first operation, estimates for the various inputs required for maintaining a certain level of agricultural production are made. Estimation of the volume of production and the marketable surplus is also made for storage and marketing needs. The units used for the purpose of such estimates in the study area were the hinterlands of central villages. The second exercise is to select optimum locations for the distribution centres of inputs and for storage and marketing facilities. The second operation will depend partly on the first one and partly on factors like the presence or absence of other functions for which the same institutions can be used.

Input distribution and storage and marketing facilities can be combined by institutions such as cooperatives. These facilities will have to be located within easy reach of the farmers so that they can get the maximum return for their investments. The entire distribution system of inputs and the marketing chain can be designed on the basis of the hierarchy of

central places which will provide locations for these services at various orders of importance and magnitude.

The following institutions have been recommended in the central villages in Pauri tehsil: distribution centres for seeds, fertilizers, pesticides and implements. Primary multi-purpose cooperatives have been recommended in each central village for this work. The stock for primary cooperatives is to be supplied by VLW headquarters and Block headquarters. For distributing credit, either cooperative credit societies or primary multi-purpose cooperatives (where cooperative credit societies may not be possible) should operate at the central village level. These institutions will be supplied by higher order credit institutions such as commercial banks and tehsil or district level institutions located in growth centres and tehsil and district headquarters.

Storage and marketing problems can also be handled at the central village level by the primary multipurpose cooperatives. Wholesale markets which will be linked with smaller markets and marketing cooperatives will be located at the service centres. Warehousing facilities for grain banking will have to be located in even higher order places like growth centres as large-scale warehousing transactions will require very large hinterlands.

Soil conservation units for advising the farmers on soil conservation measures and also for undertaking projects themselves will have to be located at least at the service centres so that each unit can cover a large hinterland and yet will be easily accessible to the farmers.

It has been recommended that initially the component of governmental assistance for the development of an adequate agricultural infrastructure will have to be quite large. In addition, the charges for some of the inputs such as establishment tax, water cess and electricity tariff will have to be subsidized for some time until the area becomes self-sufficient in food production. Hill areas such as the present study area should be under a special programme for hill area development for support of this nature.

Horticulture. There is excellent scope for the development of horticulture in the tehsil. The climate, altitude and soil of the area are ideal for the cultivation of temperate, tropical and sub-tropical fruits. Extensive horticulture can relieve the pressure on agricultural land to some extent and can bring a better per hectare return than agriculture. In spite of all these favourable factors, only scant attention has been given to this sector so far. The area under orchards is very small (3,000 hectares) and is neglected. Some of the orchards are not accessible by all-weather motorable roads and there is no provision to preserve fruits.

The present study reveals that 8,000 hectares of land can be brought under horticulture additionally by 1984. The new orchards will occupy those areas which are not suitable for agriculture but are fit for horticulture and are also not under forests. These areas will be developed by government agencies in Kanskhet, Khandiunsain, Kyark, Kaljikhal, Patisain, Mundneshwar, Srinagar, Sumari, Khirsu, Thailisain and Nautha clusters. Besides these orchards, there will be a number of small patches of fruit gardens owned by private individuals scattered all over the tehsil. In terms of areas, it is expected that about half of the proposed horticultural land will be under government sponsorship and the remaining half under private holding. Construction of roads and soil conservation measures should also be taken up simultaneously. The production of fruits in 1979 and 1984 on completion of the proposed schemes will be about 16,000 and 24,000 tonnes, respectively.

In order to achieve this level of production, a number of infrastructure facilities such as plant protection, credit, marketing and cold storage will have to be provided to the fruit farmers on a large scale. Initially, the most important requirement for fruit cultivation is

credit. It takes an average of 5 years for the fruit trees to come into production commercially. The farmers of the area do not have the resources to wait that long. Horticulture can, therefore, be started only in combination with another occupation. Credit for horticulture must be long term and with a low rate of interest. Plant protection will have to be provided regularly from the very beginning. Marketing and storage on an extensive scale can be organized later until the fruit trees are ready. At the present time, these can be provided on a small scale for removing existing deficiencies. The locations of these facilities will be in the central villages and service centres in the fruit growing areas. With an increase in the fruit production in the tehsil, a number of fruit-based industries and fruit preservation units have also been proposed in select locations.

Forestry. Forests occupy more than half of the land area of the tehsil and are undoubtedly its richest existing natural wealth. A large proportion of the forest area is under valuable coniferous timber which can be used as raw material for many different kinds of industries. The utilization of this vast forest wealth has not been done properly in the past and indiscriminate cutting and grazing have done extensive damage to the forests. These damages can easily be repaired, however, by enlightened forest development policies and by replacing degraded trees by new healthy ones. About 49,500 hectares (39 per cent of the total forest area) were found to be covered by degraded and understocked stands.

Forests cannot be developed in isolation as other fields of activity such as agriculture, horticulture, animal husbandry, industries, human habitation and commercial establishments all compete for land which is scarce in the area. Yet there is scope for further expansion of the forest area of the tehsil if the eroded slopes and barren lands are afforested. Aside from increasing the forest wealth, this measure will also provide a much needed protection from soil erosion.

A well formulated forest development policy for the area should strictly enforce the existing rules against illegal cutting and grazing, initiate afforestation of eroded and barren land and formulate guidelines for cutting of timber along scientific lines. Along with this, two important measures must be adopted. First, forest roads must be constructed to open up vast forest tracts which are currently inaccessible for transporting timber to major consumption centres. Secondly, the pressure on reserve forests must be reduced by developing community forests where both firewood collection and grazing will be allowed. Our study reveals that an additional 11,000 hectares can be added to the present 7,000 hectares under community forests.

It is estimated that about 21,000 and 28,000 cubic metres of timber will be available for industrial and other purposes from these forests in the years 1979 and 1984, respectively.

Sericulture. Sericulture in Pauri tehsil is now confined to only a few experimental farms. The possibility of its development is almost unlimited as Oak trees which are used for rearing tusser silk worms grow in the tehsil in wild profusion. The other variety of silk worms feed on Mulberry leaves. Mulberry trees grow under tropical conditions in the valleys. There is scope for increasing the area under Mulberry trees.

It has been estimated that 1,000 hectares of Mulberry trees can produce 18.5 tonnes of raw silk. The yield for Oak trees is also about the same. Given the high demand for raw silk in the country and abroad, sericulture can be developed as a major activity in the tehsil. According to one estimate, the net profits from sericulture for one hectare of Mulberry or Oak are about Rs. 1,132 and Rs. 4,800 for unirrigated and irrigated areas, respectively. With increasing demand, the profits are also likely to go up.

The infrastructure necessary for the development of sericulture in the tehsil should include nurseries for high-yielding Mulberry and Oak seedlings, silk worm seed distribution centres, marketing and reeling and weaving of raw silk. Recommendations for the location of these have been made.

Animal Husbandry. Recommendations have been made for the development of two types of animals and poultry : (1) cattle (including buffaloes), (2) sheep, and (3) poultry. Problems associated with the development of animal husbandry mainly boil down to the lack of adequate grazing area and the inferior breed of animals and poultry. It has been recommended that more area should be brought under community forests which can also be used for grazing. In addition, enough fodder from crop residues will be available with the increased agricultural production. Genetic improvement of animals has been recommended through extension agencies and veterinary hospitals at select locations. Marketing and animal insurance and animal health cover have also been recommended.

It has been estimated that with the successful implementation of the proposed improvements in cattle development, a large volume of milk(after subtracting local consumption), can be collected at various points in the tehsil. Milk collected from these points can be brought to five chilling plants located at Mundneshwar, Kandarpani, Pabau, Ghandiyal and Satpuli. About 20,000 litres and 30,000 litres are expected to be collected in 1979 and 1984. A milk pasteurisation plant has been recommended at Satpuli from where pasteurised milk can be distributed to the whole district.

For sheep development, both fodder and genetic improvement problems were examined. It was found that it would be easier to provide fodder to sheep as herbs on which sheep thrive are available in the forest in plenty. Genetic improvement in sheep is also much easier to bring about than in cattle. Appropriate programmes for such improvement have been recommended. It has been estimated that 63 tonnes of wool and 70 tonnes of mutton will be available in 1979. In 1984, the corresponding figures will be 126 tonnes of wool and 141 tonnes of mutton. Sheep rearing has been recommended in 22 clusters which provide favourable conditions for sheep development. The number of families who can depend on sheep rearing as a major occupation would be 700 in 1979 and about 1,500 in 1984.

In poultry development, local materials were recommended to be used for the construction of poultry farms. Large poultry farms on a commercial scale have been recommended in Pauri, Srinagar, Rudraprayag, Bahbazar and Satpuli. Small-scale poultry farms have also been recommended near town or army camps where electricity is available for the introduction of improved methods and where people are willing to develop poultry farming.

Industries

Agro-based industries. Mini-rice mills of the capacity of 600 tonnes per year have been recommended at various locations in Pauri tehsil. Because of the small production of paddy in the tehsil, only mills of this size have been proposed. Twelve mills have been recommended in 1979 and 19 in 1984 in 18 central villages and service centres. Sixty flour mills have been proposed in 1979 and 88 in 1984. Both paddy and wheat will be in deficit supply in 1979 but the grains have to be processed before they are eaten. The flour mills will process both wheat and mandua which is a substitute for wheat. In addition, wheat imported from outside will also have to be processed in the tehsil.

Forest-based industries. A paper mill with an initial capacity of 20 tonnes per day has been recommended at Satpuli by the year 1979. The raw materials for this mill, mainly

Pine timber, are available locally. Bamboos, also an important raw material are available in good quantities in Lansdowne tehsil. The timber can be floated down to Satpuli by Nayar rivers as well as by road. The water requirement for the mill will also be available from both of these rivers.

The pine forests in the tehsil produce enough resin for the manufacture of turpentine and rosin. The estimated yield of rosin in 1979 and 1984 will be 21,000 and 29,000 quintals, respectively. The capacity of the existing turpentine factory at Pauri can be increased to 10,000 quintals and an additional factory can be established in Thailisain which is situated at the heart of the Pine wood forests in the eastern part of the tehsil.

Saw mills have been recommended in all six growth centres. Currently there is only one saw mill in the district at Kotdwara. Timber is brought into the tehsil from Kotdwara and from other places. The six saw mills to be located in six growth centres in the tehsil will satisfy local need and will be able to export as well to places outside the tehsil at a high profit.

Sericulture. Mulberry and Oak trees which are the bases for silk worm rearing grow in the tehsil in plenty. Sericulture has been recommended in select locations where silk reeling and silk weaving industries have also been proposed.

Horticulture-based industries. Fruit preservation units have been recommended in six locations: Pauri, Srinagar, Khirsu, Satpuli, Khanskhet and Thailisain with a total capacity of 22 tonnes per day.

Wool-based industries. The number of handloom industries producing woollen fabrics and garments that can be established with the available production will be 30 in 1979 and 60 in 1984. A wool textile mill has been recommended at Thailisain. The mill can be started by 1979 with 100 looms and 500 spindles.

Social Facilities

Education. At the present time, the tehsil has 397 primary schools, 56 junior high schools and 12 high schools. In addition, there are 12 junior colleges and two degree colleges. The latter provides educational facilities for post-graduate students also. It can be seen that for 1,389 settlements these facilities are inadequate. Recommendations for additional educational facilities have been made on the basis of the needs of the study area as well as the norms suggested by the Planning Commission in its Minimum Needs Programme for the Fifth Five-year Plan. The needs of the area have been estimated by projecting the number of school going age children in the years 1979 and 1984 and the probable enrolment ratio. The Planning Commission norms recommended minimum distance of the various educational institutions from a village.

In all 430 primary schools in 1979 and 455 primary schools in 1984 have been recommended. The remaining educational institutions for 1979 and 1984 have been recommended as follows : junior high schools 1979-68, 1984-84; high schools 1979-36, 1984-45; junior colleges 1979-18 and 1984-22. The classrooms and the number of classes that will be required for these educational institutions have also been calculated and recommended.

Health. The same methods were followed in estimating the number of additional health units that will be required for the tehsil in 1979 and 1984. At the present time, there are three hospitals, 6 primary health centres, 6 dispensaries, 17 maternity and child health centres, 9 family planning units and 10 sub-centres.

Recommendations for 90 new health units in 1979 and 106 new units in 1984 have been made. The following health facilities should also be available to the people of the study area by 1984 :

	1979	1984
Beds	220	230
Doctors	33	35
Compounders	12	13
Midwives	93	109

Transportation. One of the major reasons for the backwardness of the area is its isolation. The main roads connect the urban centres only and have a total kilometreage of 117. In addition, there are 106 Kms of waterbound macadam roads and 106 Kms of kutcha roads. The remaining road linkages for the entire tehsil connecting most of the 1,389 settlements are footways and bridle paths. As most of the tehsil is unserved by motorable roads, the volume of internal passenger and goods traffic is also severely limited. The predominant modes of transportation are walking and carrying head loads. This absence of internal traffic is reflected in the serious underutilization of the existing motorable roads. These are now primarily used foı bringing imported foodgrains and other materials into the tehsil from outside centres. Projected volumes of passenger and goods traffic on these roads based on past and present trends also show underutilization except in a few places.

It has been emphasized in this report that a well-planned transportation network is essential for the development of this area. This will open up hinterlands with potential resources to major consumption centres in the tehsil and outside. It will connect villages with their central places, market centres, industries and other centres providing a wide range of functions needed for the development of agriculture, horticulture, forestry, sericulture and animal husbandry.

Recommendations have been made for 29 new road sections constituting a total length of 347 Kms. One small ropeway has been recommended for connecting Mundneshwar, Mawadhar and Kandarpani with Satpuli. In view of the potential resources in this area and the difficulty in constructing roads due to the steepness of the slopes and rugged terrain, the ropeway has been proposed. If the construction cost (about 29 lakhs) is met from the regular PWD budget, the operational costs can be easily met from tariffs charged for passenger trips and goods traffic.

Rural electrification. Recommendations made earlier for the development of the various sectors of the tehsil's economy such as agriculture, horticulture, forestry, sericulture, animal husbandry and industries were based on the assumption that the three most important inputs will be available. These inputs are : (1) a well-planned water management system, (2) a well-coordinated transportation network and (3) power. Power is probably the more crucial of the three inputs because both water management and transportation will require electricity. The success of many of our detailed recommendations for the development of the tehsil such as lift irrigation, industries, cold storage, ropeway will all depend on the availability of electricity.

At the present time, only 15 villages and the three urban centres in the tehsil have been supplied with electricity. Our proposals for rural electrification cover about 500 settlements including dependent villages, central villages, service centres and growth centres. In comparison, the number may seem quite high but it is only a little over one-third of the total

number of settlements in the tehsil. In any case, rural electrification will have to be a massive progıamme during the next ten years if our other recommendations are to be implemented.

The future estimates for power requirement have been calculated under the five standard consumption categories namely, domestic, non-domestic, street lights, industries and agricultural pumpsets. Future power requirements of industries and agricultural pumpsets were made on the basis of our proposals for new industries and the lift irrigation projects. For street lights, domestic and non-domestic use, the ratios between consumption and the cumulative presence of functions in electrified settlements were used for future estimates. Priority for electrification was given to all central villages, service centres and growth centres and irrigation projects forming clusters. Electrification was proposed for villages with 200 population or more, settlements with recommended power-operated industries and social facilities, and those lying along the transmission lines originally meant for other connections. A connection was also recommended for the proposed ropeway between Mundneshwar and Satpuli.

Concluding Remarks. The ultimate objective of the present study was to examine the extent to which rural electrification can help develop an economically backward hill area like Pauri. In order to do so, we had to make a detailed analysis of the existing and potential resources of the area and found that economic backwardness and vast natural wealth exist side by side in the tehsil. Factors that have prevented economic use of the natural wealth are, all direct and indirect consequences of the extremely difficult topography of the area. The absence of an adequate transportation network, pressure of population on a very small arable area, soil erosion due to steep slopes and uncontrolled cutting and grazing of forests, shortage of irrigation water can all be directly or indirectly related to the topography of the land. So far, very little attempt has been made to solve these problems scientifically and things have progressively deteriorated. Farmers and others have tried to survive by sheer manual labour in the past. Manual labour is not enough, however, to fight and utilize a difficult land rich with natural resources.

With power and with patient and imaginative planning, the manual labour of the people can be strengthened a million times and on much larger scale. The success of the plan recommendations made in this report will depend a great deal on human ingenuity but it must be supported by power.

APPENDICES

APPENDIX V.1 : PAURI TEHSIL : PRODUCTION, CONSUMPTION AND SURPLUS/DEFICIT OF FOODGRAINS, 1973

S. No.	Name of Cluster	Rice			Wheat			Barley		
		Production	Consumption	Surplus/ Deficit	Production	Consumption	Surplus/ Deficit	Production	Consumption	Surplus/ Deficit
1	2	3	4	5	6	7	8	9	10	11
1.	Bahbazar	584	1200	—616	717	1308	—591	167	84	+83
2.	Ghindwara	2720	3076	—356	3377	3383	—6	490	212	+278
3.	Baganikhal	1849	2206	—357	2268	2410	—142	621	155	+466
4.	Diusi	788	1232	—444	967	1343	—376	279	87	+192
5.	Ghandiyal	1364	2024	—660	1673	2205	—532	302	142	+160
6.	Kanskhet	1176	2325	—1149	1442	2535	—1093	276	163	+113
7.	Nahsain	1688	2765	—1077	2070	3007	—937	214	189	+25
8.	Safdarkhal	1312	2769	—1457	1609	3019	—1410	287	195	+32
9.	Kamalpur	437	2004	—1567	536	2170	—1634	102	137	+35
10.	Jamlakhal	1112	2428	—1316	1447	2632	—1185	453	179	+274
11.	Delchaunri	1560	3525	—1965	1913	3843	—1930	337	248	+89
12.	Khandiunsain	1315	2255	—940	1613	2457	—844	130	158	—28
13.	Kot	1342	2932	—1590	1726	3195	—1469	183	206	—23
14.	Kholchaunri	694	2000	—1306	852	2180	—1328	201	140	+61
15.	Lwali	1189	2013	—824	1458	2194	—736	135	141	—6
16.	Adhwani	391	925	—534	474	1007	—533	93	66	+27
17.	Kalgikhal	956	2150	—1194	1172	2339	—1167	218	148	+70
18.	Sakikhet	647	1090	—443	793	1165	—372	193	78	+115
19.	Banghat	716	1648	—932	878	2011	—1133	301	127	+174
20.	Satpuli	778	1327	—549	955	1444	—489	445	91	+354
21.	Kandarpani	1234	2415	—1181	1513	2627	—1114	741	164	+577
22.	Mawadhar	436	699	—263	535	976	—441	209	64	+145
23.	Patisain	292	993	—701	359	1069	—710	166	63	+103
24.	Mundneshwar	1183	2260	—1077	1451	2408	—957	479	187	+292

APPENDIX V.1 : (*Contd*)

1	2	3	4	5	6	7	8	9	10	11
25.	Pipalipani	472	1740	—1268	580	1889	—1309	256	120	+ 136
26.	Jakheti	602	1926	—1324	738	2095	—1357	315	132	+183
27.	Agrora	1122	1656	—534	1377	2349	—972	768	114	+654
28.	Paidul	707	1663	—956	925	1810	—885	199	114	+85
29.	Parsundakhal	1053	3244	—2191	1292	3530	—2238	156	220	—64
30.	Kandara	628	2005	—1377	770	2165	—1395	103	141	—38
31.	Bubakhal	536	987	—451	658	1075	—417	221	69	+152
32.	Daduadevi	493	1246	—753	605	1358	—753	161	88	+73
33.	Pauri	1863	11813	—9950	1707	12516	—10809	276	846	—570
34.	Kyark	1307	2371	—1064	1603	2578	—975	250	171	+79
35.	Kirtinagar	469	1118	—649	575	1217	—642	119	79	+40
36.	Srinagar	821	5946	—5125	1144	6471	—5327	88	414	—326
37.	Sumari	1823	3641	—1818	2073	3962	—1889	477	246	+231
38.	Chaubatiakhal	642	2075	—1433	758	2264	—1506	157	146	+11
39.	Choprium	344	1739	—1395	422	1888	—1466	262	122	+140
40.	Bainswara	318	1250	—932	390	1362	—972	42	88	—46
41.	Sikukhal	688	2127	—1439	844	2318	—1474	195	149	+46
42.	Pokhrikhet	869	2890	—2021	1065	3134	—2069	525	196	+ 329
43.	Champeshwar	688	2601	—1913	881	2835	—1954	278	183	+95
44.	Pabau	781	3019	—2238	957	3290	—2333	192	212	—20
45.	Khirsu	1478	4295	—2817	1871	4693	—2822	281	292	—11
46.	Bhattisera	917	2178	—1261	1154	2370	– 1261	214	154	+ 60
47.	Kherkhal	1979	4429	—2450	2520	4826	—2306	336	311	+25
48.	Mailisain	715	1753	—1038	901	1910	—1009	335	124	+211
49.	Chifalghat	592	1804	—1212	750	1977	—1227	122	127	—5
50.	Sankarsain	552	1639	—1087	676	1786	—1110	208	115	+93
51.	Cholusain	510	1422	—912	625	1550	—925	150	100	+50
52.	Bajwar	256	886	—630	314	964	—650	80	62	+18
53.	Damdeval	300	1660	—1360	368	1809	—1441	223	116	+107

Appendix V 1 : (Contd)

1	2	3	4	5	6	7	8	9	10	11
54.	Chaunrikhal	204	494	—290	250	526	—276	103	40	+63
55.	Pokhri	279	896	—617	371	974	—603	97	66	+31
56.	Bhira	522	1170	—648	676	1274	—598	180	80	+100
57	Thailisain	1135	4236	—3101	1392	4608	—3216	1101	288	+813
58.	Nautha	707	2232	—1525	879	2437	—1558	174	157	+17
59.	Chakisain	709	2185	—1476	869	2377	—1508	232	151	+81
60.	Parthani	816	2568	—1752	1001	2793	—1792	296	176	+220
61.	Barsuri	1193	3450	—2257	1512	3754	—2242	313	233	+80
62.	Rudraprayag	1332	3673	—2341	1752	4002	—2250	344	258	+86
63	Khankara	554	908	—354	747	989	—242	79	64	+15
64.	Sumerpur	245	561	—316	342	611	—269	101	44	+57
65.	Ratura	494	2027	—1533	640	2275	—1635	263	146	+117
66.	Molkakhal	341	1903	—1562	418	2071	—1653	265	130	+135
67.	Gidokhal	94	485	—391	115	528	—413	52	39	+13
68.	Chaunra	832	3334	—2502	928	3666	—2738	300	228	+72
69	Gadoli	773	2225	—1452	948	2420	—1472	218	154	+64
70	Tarpali	378	878	—500	464	956	—492	60	61	—1
71.	Bungidhar	1357	4822	—3465	1717	5154	—3437	841	339	+502
72.	Samoya	753	1626	—873	924	1772	—848	561	114	+447
	Total	**62006**	**163057**	**—101051**	**76286**	**178105**	**—101819**	**19591**	**11343**	**+8248**

Appendix V.2 : Pauri Tehsil : Estimated Cultivable Land in 1984 (Existing Fallow, Net Sown and Potential Agricultural Area)

S. No.	Name of the Cluster	Potential agricultural area	Potential agricultural area as percentage to geographical area	Net sown area in 1984	Double cropped area in 1984	Double cropped area as percentage to net sown area	Gross cultivated land in 1984
1	2	3	4	5	6	7	8
1.	Bahbazar	279.50	18.90	783.05	526.04	67.18	1309.09
2.	Ghındwara	660.00	14.34	2713.57	1068 13	39.36	3781.70
3.	Baganikhal	755.00	20 58	2355.53	559.45	23.75	2914.98
4.	Diusı	322.00	12.64	1118.60	439.02	39.25	1557.62
5.	Ghandiyal	615.00	22.59	1576.67	853.57	54.14	2430.24
6.	Kanskhet	640.00	23.37	1460 96	548.26	37.53	2009.22
7.	Nahsain	497.50	14.59	1547.01	684.39	44.24	2231.40
8.	Safdarkhal	320 00	13.12	1346 55	537.52	39.92	1884.07
9.	Kamalpur	462.50	18.68	909.23	619 73	68.16	1528.96
10.	Jamlakhal	295.00	10.79	1426.67	730.57	51.21	2157.24
11.	Delchaunri	400.00	13.68	1603.93	500.60	31.21	2104.53
12.	Khandiunsain	40.00	1.94	893.12	481.59	53 92	1374.71
13.	Kot	17.50	0.91	948.40	514.71	54.27	1463.11
14.	Kholchaunri	257.50	14.03	926.71	591.56	63.83	1518.27
15.	Lwali	380.00	16.99	1133.41	612.42	54.03	1745.83
16.	Adhwani	147.50	5.49	484.83	350.23	72.24	835.06
17.	Kaljikhal	52.50	2.64	979.60	426.77	43.57	1406.37
18.	Saknıkhet	415.60	32.51	921.96	655.64	71.10	1577.60
19.	Banghat	540.00	23.18	1404.11	776.66	55.31	2180.77
20.	Satpuli	177.50	11.84	1188.67	701.91	59.05	1890.58

APPENDIX V.2 : (*Contd.*)

1	2	3	4	5	6	7	8
21.	Kandarpani	205.00	10.33	1344.50	911.26	67.78	2255.76
22	Mawadhar	102.50	7.36	521.54	284.82	54.61	806.36
23.	Patisain	70 00	6.88	415.80	192 16	46.21	607.96
24.	Mundneshwar	100 00	5.26	1149.24	709.41	61.73	1858.65
25	Pipalpani	—	—	571.75	12.28	2.15	584.03
26.	Jakheti	130 00	9.45	839.26	372.18	44.35	1211.44
27.	Agrora	334.19	23.40	903.04	534.78	59.20	1437.82
28.	Paidul	207.50	14.19	751.69	493.86	65.70	1245.55
29.	Parsundakhal	165.00	7.47	1235.85	684.18	55.36	1920.03
30.	Kandara	185.00	12.99	654.95	358.54	54.74	1013.49
31.	Bubakhal	—	—	565.95	206.36	36.46	772.31
32.	Daduadevi	207.02	19.02	608.25	337.65	55.57	945.90
33.	Pauri	107.50	2.23	1293.44	619.42	47.89	1912.86
34.	Kyark	182.50	8.24	1233.65	724.96	58.77	1558 61
35.	Kirtinagar	335.00	22.85	788.07	396.15	50.27	1184.22
36.	Srinagar	855.00	39.36	1378.36	672.45	48.79	2050.81
37.	Sumari	472.50	12.11	2073.18	725.03	34.97	2798.21
38.	Chaubatiakhal	263.80	10 20	656.12	267.77	40.81	923.89
39.	Choprium	15.00	0.71	362.62	236.48	65.21	599.10
40.	Bhainswara	—	—	219.57	122.94	55.99	342.51
41.	Sikukhal	40.00	2.27	565.34	308.13	54.50	873.47
42.	Pokhrikhet	90.00	4.42	1294.78	606.01	46.80	1900.79
43.	Champeshwar	185.00	4.71	827.16	554.53	67.04	1381.69
44.	Pabau	102.50	2.85	923.37	498.68	54.01	1422.05
45.	Khirsu	200.00	3.42	1533.10	1096.76	71.54	2629.86
46.	Bhattisera	315.00	11.20	1117.08	946.03	84.69	2063.11

APPENDIX V 2 (*Contd*)

1	2	3	4	5	6	7	8
47	Kherakhal	440 00	11 12	1639 07	1035 49	63 18	2674 56
48.	Mailisain	230 00	8 28	959 22	733 08	76 42	1692 30
49	Chifalghat	390 00	13 32	897 14	593 44	66.14	1490 58
50	Sankaisain	440 00	21 36	943 72	504 69	53 48	1448 41
51	Cholusain	82 50	5 78	710 69	121 79	17 13	832 48
52	Bajwar	—	—	235 53	125 41	53 25	360 94
53	Damdeval	247.50	4.88	694 04	370 47	53.37	1064 51
54.	Chaundrikhal	10.00	0 29	246 25	118.69	48 19	364 94
55.	Pokhri	—	—	196.47	124 41	63 32	320 88
56.	Bhira	—	—	450.53	245 80	54.55	696 33
57.	Thailisain	337.50	3.29	1621.26	1060 29	65.39	2681.55
58.	Nautha	282.50	2.88	833 37	496.33	59 56	1329 70
59.	Chakisain	302 50	9.84	858 03	707.89	82 50	1565 92
60.	Paithani	20 00	0.63	721 94	336.68	46 63	1058.62
61.	Barsuri	187 50	3.19	1048 56	653 86	62.36	1702 42
62.	Rudraprayag	340.00	6.77	1548.06	819.84	52 96	2367 90
63.	Khankara	145.00	6.03	461.97	328 71	71.15	790.68
64.	Sumerpur	10.00	0.43	285 99	94.13	32.91	380.12
65.	Ratura	217.50	7.61	794.16	552 80	69.61	1346.96
66.	Molkakhal	75.00	1.21	700.12	337 16	48.15	1037.28
67.	Gidokhal	80.00	1.98	250 47	88.32	35.26	338.79
68.	Ghaunra	540.00	10.66	1560 12	355 63	22 80	1915 95
69.	Gadoli	150.58	2.11	790.08	528.52	66.90	1318.60
70.	Tarpali	—	—	283 51	179.64	69.71	463.15
71.	Bungidhar	707.50	5.85	2262.62	1499.16	56.30	4161.78
72.	Samoya	431.60	10.94	1635.63	1076 02	65.79	2711.65
	Total	**17830.00**	**8.00**	**72703.99**	**38021.10**	**52.4**	**110725.09**

APPENDIX V 3 : PAURI TEHSIL : EXISTING AND PROPOSED IRRIGATED AREAS

(In hectares)

S. No.	Name of the Cluster	Existing irrigated areas	5th Five-year Plan proposal	NICD proposal 1974-79	Total area irrigated by 1979	NICD proposal 1979-84	Total area irrigated by 1984	Irrigated land in 1984 as percentage to net sown area 1984
1	2	3	4	5	6	7	8	9
1.	Bahbazar	—	—	130	130	110	240	30 65
2.	Ghindwara	34	80	210	324	286	610	22.48
3.	Baganikhal	—	—	140	140	230	370	15.71
4.	Diusi	—	20	60	80	90	170	15.20
5.	Ghandiyal	—	—	110	110	110	220	13.95
6.	Kanskhet	—	—	130	130	210	340	23.27
7.	Nahsain	—	—	144	144	216	360	23 27
8.	Safdarkhal	—	—	56	56	84	140	10 40
9.	Kamalpur	—	—	50	50	60	110	12.10
10.	Jamlakhal	69	238	—	307	51	358	25.09
11.	Delchaunri	—	—	100	100	160	260	16.21
12.	Khandiunsain	—	—	75	75	110	185	20.71
13.	Kot	66	—	120	186	160	346	36.48
14.	Kholchaunri	—	—	110	110	140	250	26.98
15.	Lwali	—	—	50	50	100	150	13.23
16.	Adhwani	—	—	50	50	80	130	26.81
17.	Kaljikhal	—	—	50	50	80	130	13.27
18.	Saknikhet	—	—	90	90	60	150	21.46
19.	Banghat	78	27	30	135	50	185	13.18
20.	Satpuli	—	90	—	90	—	90	7.57
21.	Kandarpani	—	—	100	100	150	250	18.59

APPENDIX V.3 : (*Contd.*)

1	2	3	4	5	6	7	8	9
22.	Mawadhar	—	—	20	20	—	20	3.83
23.	Patisain	—	—	—	—	—	—	—
24.	Mundneshwar	—	—	30	30	60	90	7.83
25.	Pipalpani	—	—	—	—	—	—	—
26.	Jakheti	—	—	40	40	—	40	4.77
27.	Agrora	—	—	40	40	50	90	12.33
28.	Paidul	48	15	70	133	100	233	31.00
29.	Parsundakhal	—	—	60	60	90	150	12.14
30.	Kandara	—	—	50	50	40	90	13.74
31.	Bubakhal	—	—	—	—	—	—	—
32.	Daduadevi	—	—	40	40	60	100	24.17
33.	Pauri	60	60	130	250	190	440	34 02
34.	Kyark	—	—	90	90	120	210	17.02
35.	Kirtinagar	—	—	30	30	30	60	7.61
36.	Srinagar	95	90	80	265	120	385	27.93
37.	Sumari	24	—	70	94	210	304	14.66
38.	Chaubatiakhal	20	—	40	60	—	60	13.52
39.	Choprium	—	—	50	50	70	120	33.09
40.	Bhainswara	—	—	—	—	—	—	—
41.	Sikukhal	—	—	—	—	—	—	—
42.	Pokhrikhet	—	—	60	60	80	140	10.81
43.	Champeshwar	31	—	90	121	140	261	31.55
44.	Pabau	—	32	110	142	120	262	28.37
45.	Khirsu	49	126	70	245	130	375	24.46
46.	Bhattisera	24	8	40	72	90	162	14.50
47.	Kherakhal	76	24	50	150	90	240	14.64

APPENDIX V.3 : (*Contd.*)

1	2	3	4	5	6	7	8	9
48.	Mailisain	20	—	70	90	100	190	19.81
49.	Chifalghat	20	—	70	90	90	180	20 06
50.	Sankarsain	—	—	90	90	70	160	16.95
51.	Cholusain	—	—	60	60	80	140	19.70
52.	Bajwar	—	—	40	40	20	60	25.47
53.	Damdeval	—	—	—	—	—	—	—
54.	Chaunrikhal	—	—	20	20	—	20	8.12
55.	Pokhri	24	15	—	39	30	69	6.44
56.	Bhira	30	15	30	75	45	120	26.64
57.	Thailisain	—	—	130	130	300	430	26 52
58.	Nautha	10	—	60	70	140	210	25.20
59.	Chakisain	—	—	70	70	140	210	24.47
60.	Paithani	—	—	70	70	120	190	26 32
61.	Barsuri	40	—	50	90	130	220	20.98
62.	Rudraprayag	98	—	20	118	80	198	12.79
63.	Khankara	56	60	—	116	30	146	31.60
64.	Sumerpur	35	16	—	51	—	51	17.83
65.	Ratura	28	60	50	138	80	218	27.45
66.	Molkakhal	—	40	36	76	90	166	23.71
67.	Gidokhal	—	—	—	—	—	—	—
68.	Chaunra	—	30	100	130	65	195	12.50
69.	Gadoli	—	—	75	75	90	165	25.81
70.	Tarpali	—	—	40	40	20	60	21.16
71.	Bungidhar	44	20	90	154	110	264	9.92
72.	Samoya	—	—	95	95	90	185	11.31
	Total	**1079**	**1066**	**4331**	**6476**	**6247**	**12723**	**17.50**

APPENDIX V.4 : PAURI TEHSIL : ESTIMATED REQUIREMENT OF PUMPSETS FOR LIFT IRRIGATION 1979 AND 1984

S. No	Name of the Cluster	Proposed land for lift irrigation (in ha)			Anticipated requirement of pumpsets (in BHP)		
		Up to 1979	1979 to 1984	Total up to 1984	Up to 1979	1979 to 1984	Total up to 1984
1	2	3	4	5	6	7	8
1.	Bahbazar	55	—	55	420	—	420
2.	Ghindwara	130	206	336	990	1565	2555
3.	Baganikhal	70	130	200	520	990	1520
4.	Diusi	80	—	80	585	—	585
5.	Ghandiyal	80	70	150	610	535	1145
6.	Kanskhet	40	50	90	305	380	685
7	Nahsain	100	150	250	745	1140	1885
8.	Safdarkhal	56	40	96	—	305	305
9.	Kamalpur	56	64	120	425	485	910
10.	Jamlakhal	210	26	236	1560	200	1760
11.	Delchaunri	60	60	120	455	455	910
12.	Khandiunsain	35	20	55	265	150	415
13.	Kot	100	100	200	685	655	1340
14.	Kholchaunri	40	40	80	305	305	610
15.	Lwali	30	70	100	180	425	605
16.	Adhwani	30	20	50	220	150	370
17.	Kaljikhal	30	80	110	240	550	790
18.	Saknikhet	50	60	110	380	455	835
19.	Banghat	47	50	97	355	340	695
20.	Satpuli	50	—	50	340	—	340
21.	Kandarpani	50	50	100	380	380	760
22.	Mawadhar	—	150	150	—	1140	1140
23.	Patisain	—	—	—	—	—	—
24.	Mundneshwar	—	60	60	—	455	455
25.	Pipalpani	—	—	—	—	—	—
26.	Jakheti	40	—	40	305	—	305
27.	Agrora	40	—	40	305	—	305
28.	Paidul	40	80	120	245	610	855
29.	Parsundakhal	60	90	150	365	610	975
30.	Kandara	—	—	—	—	—	—
31.	Bubakhal	—	—	—	—	—	—
32.	Daduadevi	40	—	40	275	—	275
33.	Pauri	100	100	200	640	760	1400
34.	Kyark	40	90	130	305	685	990

APPENDIX V 4: (*Contd*)

1	2	3	4	5	6	7	8
35.	Kirtinagar	—	—	—	—	—	—
36	Srinagar	150	120	270	800	660	1460
37.	Sumari	50	30	80	290	210	500
38	Chaubatiakhal	—	—	—	—	—	—
39	Choprium	30	50	80	230	380	610
40	Bhainswara	—	—	—	—	—	—
41	Sikukhal	—	—	—	—	—	—
42.	Pokhrikhet	60	80	140	455	550	1005
43	Champeshwar	60	110	170	440	835	1275
44	Pabau	50	—	50	350	—	350
45.	Khirsu	—	—	—	—	—	—
46	Bhattisera	—	60	60	—	365	365
47.	Khetakhal	30	50	80	230	380	610
48	Mailisain	30	100	130	230	730	960
49.	Chifalghat	40	—	40	305	—	305
50	Sankarsain	40	70	110	305	530	835
51	Cholusain	30	40	70	230	305	535
52.	Bajwar	—	—	—	—	—	—
53.	Damdeval	30	40	70	230	305	535
54.	Chaunrikhal	—	—	—	—	—	—
55.	Pokhri	—	—	—	—	—	—
56.	Bhira	—	—	—	—	—	—
57.	Thailisain	90	230	320	685	1750	2455
58.	Nautha	—	50	50	—	380	380
59.	Chakisain	30	30	60	230	230	460
60.	Paithani	40	70	110	305	530	835
61.	Barsuri	—	—	—	—	—	—
62.	Rudraprayag	20	60	80	150	455	605
63.	Khankara	40	—	40	305	—	305
64.	Sumerpur	—	—	—	—	—	—
65.	Ratura	30	50	80	230	305	535
66.	Molkakhal	—	—	—	—	—	—
67.	Gidokhal	—	—	—	—	—	—
68.	Chaunra	50	25	75	380	190	570
69.	Gadoli	40	60	100	305	455	760
70.	Tarpali	20	—	20	150	—	150
71.	Bungidhar	40	40	80	305	305	610
72.	Samoya	30	30	60	230	230	460
	Total	**2653**	**3211**	**5864**	**19205**	**23500**	**42705**

APPENDIX V 5 : PAURI TEHSIL : AREA UNDER DIFFERENT

S. No.	Name of the Cluster	Gross Sown Area	Paddy		Wheat		Barley	
			Area	Percentage	Area	Percentage	Area	Percentage
1	2	3	4	5	6	7	8	9
1.	Bahbazar	737.29	160.50	21.67	160.50	21.67	60.22	8 13
2.	Ghindwara	2045.70	835 56	27.43	835.56	27 43	149 69	4 91
3.	Baganikhal	2171.61	474 62	21.85	479.62	22.08	173 43	7 98
4.	Diusi	1216.37	289.59	23.81	289.59	23.81	113.32	9.32
5.	Ghandiyal	1451.43	352.94	24.32	352.94	24 32	98.49	6.79
6.	Kanskhet	1320.22	328.72	24.90	328 72	24.90	99.24	7.52
7.	Nahsain	1628.90	450.92	27.68	450.92	27.68	68 85	4.23
8.	Safdarkhal	1473.18	346.61	23.53	346.61	23.53	104.73	7.11
9.	Kamalpur	689.41	149.05	21.63	146 85	21.31	51 99	7.54
10.	Jamlakhal	1421.68	389.06	27.37	397.16	27.94	162.60	11.44
11.	Dechaunri	1625.72	410.09	25.22	410.09	25.22	108.45	6.67
12.	Khandiunsain	1312.59	376 73	28 70	376.73	28.70	44.72	3 41
13.	Kot	1488.51	476.80	32 03	446.80	30.02	43.57	2.93
14.	Kholchaunri	985.77	227.00	23 02	233.00	23.63	73.77	7.49
15.	Lwali	1092.83	295.90	27.08	295.90	27.08	44.03	4 03
16.	Adhwani	492.14	103.00	20.93	103.00	20.93	37.08	7.53
17.	Kaljikhal	1274.67	299.81	23.52	299.81	23.52	98.07	7.69
18.	Saknikhet	919.38	235.96	25.67	235.96	25.67	70.36	7.66
19.	Banghat	1331.76	345.10	25.91	345.10	25.91	81.69	6.13
20.	Satpuli	1539.17	337.20	21.91	307.20	19.96	158.94	10.33
21.	Kandarpani	1845.95	369.20	20.00	369.20	20.00	234.70	13.20
22.	Mawadhar	653.36	140.90	21.57	140.80	21.57	74.40	11.39
23.	Patisain	506.26	80.30	15.86	80.30	15.86	65.88	13.02

CROPS AND PERCENTAGE TO THE GROSS SOWN AREA—1979 (AREA IN HECTARES)

Mandua		Jhangora		Pulses		Vegetable	
Area	Percentage	Area	Percentage	Area	Percentage	Area	Percentage
10	11	12	13	14	15	16	17
239 62	32 35	60 22	8.13	28 11	3.79	28 12	3 79
824 34	27 06	140 69	4 62	129 93	4 27	129 93	4 27
666 66	30 69	172 63	7 95	102 32	4 72	102 33	4 72
322 94	26 55	103 82	8.54	46 55	3 99	48.56	3 99
433 27	29 84	98 49	6 79	57 65	3.97	57 65	3 97
374 02	28 33	99 24	7.52	46 14	3 48	46 14	3.48
462 72	28 41	68 38	3 89	63 38	3 89	63.39	3.89
450 53	30 58	104 73	7 11	59 98	4.07	59.99	4 07
215 49	31.27	76.79	11 14	24.62	3.57	24 62	3.57
169 00	11 89	171.30	12 05	66.28	4 66	66.28	4.66
453 50	27 90	108.45	6.67	67.57	4.16	67.57	4.16
362 18	27.59	44 72	3 41	53 75	4 09	53 76	4 10
345 90	23 24	43 64	2 93	65 90	4 43	65.90	4.43
300 49	30 47	73 77	7 49	38.87	3.95	38.87	3.95
321.07	24.38	44 03	4.03	45 95	4.20	45.95	4.20
171 50	34 85	37.08	7 53	20.24	4.11	20 24	4.11
370.01	29.03	98.07	7.69	54.45	4 27	54.45	4.27
232.90	25.34	70 36	7.66	36 92	4.02	36.92	4.02
369.33	27.74	81.69	6.13	54.42	4.09	54.43	4.09
441.24	28 67	158 94	10 33	67.82	4 41	67 83	4.41
468.80	25 39	243.60	13 20	75.72	4 10	75.73	4.10
171 90	26.32	74 40	11.39	25.43	3.89	25.43	3.89
173.90	34 34	65 88	13.02	20.00	3.95	20.00	3.95

APPENDIX

1	2	3	4	5	6	7	8	9
24.	Mundneshwar	1588 69	326 50	20.55	326 50	20 55	174 60	10.99
25.	Pıpalpanı	789.04	113 62	14 40	113 62	14.40	97 07	12 30
26.	Jakhctı	1045.65	197 67	18.90	197.67	18 90	105 30	10.08
27.	Agroıa	1302.27	349.94	26 87	349 94	26.87	247 00	18 97
28.	Paıdul	904.65	243.77	26 96	243 77	26 96	63.21	6 98
29.	Parsundakhal	1659.17	463.32	27 92	463.32	27 92	67 73	4 08
30.	Kandara	741 49	201 02	27 12	201.02	27 12	42 08	5.66
31.	Bubakhal	773.33	168 00	21.73	168.00	21.73	84 15	10 88
32.	Daduadevı	719 82	168.62	23.43	179 10	24 88	83 27	11 57
33.	Paurı	1812 27	495 59	27 35	459 50	25 35	109 95	6.07
34.	Kyark	1733 06	514 30	29 68	514 30	29 68	92 11	5.31
35.	Kirtınagar	624.48	136 77	21.90	136 77	21.90	57 17	9.15
36.	Srinagar	1030.01	329 90	32 03	329 90	32 03	44.60	4.33
37.	Sumari	2574.01	587.05	22 81	590 65	22 95	241 11	9 37
38.	Chaubatıakhal	769.78	203.79	26 48	202 69	26 34	82.08	10.66
39.	Choprium	574 40	107 06	18 64	118 46	20 62	104.00	18.11
40.	Bhainswara	344 51	86 40	25.08	86 40	25 08	16.00	4.64
41.	Sikukhal	803.51	175 48	21 90	175 48	21.90	61.00	7 60
42.	Pokhrikhet	1795.79	292 88	16 32	292.88	16 32	198 00	11.03
43.	Champeshwar	1017.69	228.40	22 44	251.50	24.71	85.64	8.41
44.	Pabau	1228.55	317.72	25 86	340 58	27.72	73.84	6.00
45.	Khirsu	2289.36	583 50	25.49	633.53	27 67	136 83	5.78
46.	Bhattısera	1462.12	437.35	29.91	439.55	30.06	94.24	6.46
47.	Kherakhal	1880.96	481 83	25 61	464 72	24 70	112 70	5 97
48.	Mailisain	1017.29	221.00	21.72	221.00	21.72	124.60	12 25
49.	Chifalghat	835 58	251 .44	30.10	251.44	30.10	41 97	5.14

V 5 : (*Contd.*)

10	11	12	13	14	15	16	17
467 19	29.41	174 60	10 99	59.65	3 75	59 65	3 75
297 01	37 63	97.07	12 30	35.32	4 48	35 33	4 48
348 89	33 36	105 30	10 08	45 41	4 34	45.41	4 34
252 50	19 39	27 00	2 08	37.94	2 91	37.95	2 91
220.59	24 38	63 21	6 98	35.05	3.87	35 05	3.87
394 30	23 76	156 47	9 43	57.01	3 44	57 07	3 44
191 64	25 85	42 08	5 66	31 82	4 29	31 83	4 29
196 28	25 38	84 15	10 88	36 37	4 70	36.38	4.70
142 00	19 73	83 287	11 57	31 78	4.41	31.78	4.41
496 75	27.40	109 95	6 07	70.26	3.88	70.27	3.88
386 68	-2 32	92 11	5.31	66.78	3 85	66.78	3.85
183 82	29.44	57 14	9 15	26.40	4 23	26 41	4.23
218 20	21 19	44 60	[illegible] 33	31.40	3.05	31. 1	3.05
731 59	28 42	247 61	9 37	88 00	3.42	88 00	3.42
128 03	16.63	70 90	9 21	41.14	5 34	41 15	5.34
149 16	25.97	59 90	10 43	17.91	3 12	17.91	3.12
100.19	29 09	16.02	4 65	19.75	5.73	19.75	5.73
215 34	33 08	60 00	7.50	31.10	4.10	32 11	4.01
657.16	36.60	212.20	11.82	71.82	3 97	71.34	3.97
256.63	25 23	108 64	10 67	43.44	4.27	43.44	4.27
286.45	23 32	98 10	7.98	55.93	4.55	55.93	4.55
600 65	26 24	166 83	7.29	84.01	3.67	84.01	3.67
273.21	18 68	96.36	6 59	60.70	4 15	60.70	4.15
523.75	28 06	148.47	7.80	72.92	3.88	72.13	3.88
218 84	21.52	124 60	12 25	53.63	5.27	53.63	5.27
175 45	21.00	42.47	5.14	36.40	4.35	36.41	4.35

APPENDIX

1	2	3	4	5	6	7	8	9
50.	Sankarsain	777 41	172 63	22 22	172 63	22 22	72 04	9.26
51.	Cholusain	709 08	162 60	22.77	162.60	22 77	59 91	8 56
52.	Bajwar	364 94	81.53	22 34	81 52	22.34	31 62	8 66
53.	Damdeval	723.01	182.16	25 19	182 16	25 19	73 53	10 17
54.	Chaunrikhal	364 94	69 03	18 92	69 03	18 92	44 05	12 07
55.	Pokhri	310.88	79 00	25 41	79 00	25 41	24 00	7 72
56.	Bhira	702 33	159.00	22.64	159 00	22 64	62 00	8 83
57.	Thailisain	2105.04	313 00	14.87	313 00	14 87	363 00	17 24
58.	Nautha	957.21	234.53	24.50	234 53	24 50	65 38	6 83
59.	Chakisain	1059 91	270 44	25 52	270 44	25.52	86 35	8 15
60.	Paithani	1084 87	246 28	22 71	250 43	23 08	97 60	9.00
61.	Barsuri	1276 12	290 02	22.73	300 38	23 54	97 90	7 67
62.	Rudraprayag	1834 94	386 72	21 08	386 72	21 08	190.57	10.39
63.	Khankara	489.20	126 02	25.76	134 02	27 39	24 80	5 07
64.	Sumerpur	372.13	59.60	16.02	59 60	16 02	37 62	10.11
65.	Ratura	922.36	243 55	26 41	243.55	26 41	86 18	9.34
66.	Molkakhal	964 28	133.95	13 89	172 50	17 89	148.69	15 43
67.	Gidokhal	249.09	42.52	17 07	46 46	18.65	24 22	9 72
68.	Chaunra	1338.75	260.00	19.43	344 60	25.74	109.73	8 20
69.	Gadoli	760 96	237.80	31.25	252 30	33.16	72.96	6.59
70.	Tarpali	454 50	131.00	28.82	131.00	28.82	21.85	4.81
71.	Bungidhar	3158 67	687.13	21 75	820.06	25 96	316.80	10 03
72.	Samoya	1911.05	391.09	20.46	416.72	21.82	229.25	12.00
	Total	**84443.05**	**20078 08**	**23.77**	**20467 01**	**24.23**	**7207.16**	**7 80**

V 5 : (*Contd.*)

10	11	12	13	14	15	16	17
224 27	28 84	72 04	9 26	31.90	4 10	31.90	4.10
199 35	28 22	59 91	8 56	32 35	4 56	32 36	4.56
105 14	28 81	31 62	8 66	16.75	4 59	16 75	4.59
142.53	19 71	73 53	10 17	34 55	4 78	34 55	4.78
106 38	29 15	44.05	12 07	16 20	4 44	16.20	4.44
77 00	24 78	24 00	7 72	13 94	4 48	13 94	4.48
198 00	28 19	62 00	8 83	31 16	4 44	31.17	4 44
669 72	31 82	394 00	18.72	26 16	1 24	26.07	1.24
259 64	27 12	65 38	6 83	48 87	5 11	48.88	5.11
261 02	24 63	86 35	8 15	42 65	4 02	42.66	4 02
296 10	27 29	107 60	9.92	43.43	4.00	43.43	4.00
374 68	29.36	103 26	8 09	54 94	4.31	54.94	4.31
547.90	29 86	189.47	10 33	66.78	3.69	66.78	3.69
125.08	25.57	33.80	6 91	22.74	4.65	22.74	4.65
89.53	24 08	37.62	10.11	44 02	11 83	44.03	11.83
175 39	19.02	86.18	9 34	43.75	4 74	43.76	4.74
249 16	25.83	187 41	19.44	36.28	3 76	36.29	3.76
36.00	14.45	84 00	33.73	7 94	3 19	7.95	3.19
364.44	27.22	140.73	10 51	59 62	4.45	59.63	4 45
15.00	1.97	99.46	13.07	41.72	5.48	41.72	5.48
110.65	24.35	21.85	4.81	19.07	4.20	19.08	4.20
741.11	23.46	372 58	11 80	110 49	3 50	110.50	3.50
480.44	25 14	271.45	14.20	61 05	3 19	61.05	3.19
22356 24	**26 47**	**7434 96**	**8 08**	**3402 61**	**4.03**	**3502.95**	**4.62**

APPENDIX V.6 : PAURI TEHSIL . AREA UNDER DIFFERENT

S. No.	Name of Cluster	Gross Sown area	Paddy		Wheat		Barley	
			Area	Percentage	Area	Percentage	Area	Percentage
1	2	3	4	5	6	7	8	9
1.	Bahbazar	1309 09	420 50	32 12	420 50	32 10	60 22	4 61
2.	Ghindwara	3781 70	941 56	24 89	941 56	24 89	169.69	4 48
3	Baganikhal	2914.98	744.62	25 54	749 62	25 54	204 43	7.01
4.	Diusi	1557 62	319.59	20 52	319 59	20 52	128 32	8 23
5.	Gnandiyal	2430 24	707 94	29 13	707.94	29 13	113 49	4 67
6.	Kanskhet	2009 22	462 72	23 03	462 72	23 03	118 24	5 88
7.	Nahsain	2231.40	535 92	24 03	535 92	24 03	87 85	3 93
8.	Safdarkhal	1884 07	425 50	22 58	425 50	22 58	112 73	5.98
9.	Kamalpur	1528 96	405 10	26 50	402 90	26 34	66 99	4 38
10.	Jamlakhal	2157 24	479 06	22.22	487.16	22 59	180 60	8.48
11.	Delchaunri	2104 53	715 09	33.98	715 09	33.98	124 45	5 96
12.	Khandiunsain	1374 71	416 25	30.28	416.25	30 28	42 72	3.11
13.	Kot	1463.11	486.60	33 26	486 60	33.26	38.57	2.63
14.	Kholchaunri	1518.27	427.00	28.10	433.00	28.50	79 77	5 25
15.	Lwali	1745.83	485.90	27 83	485 90	27.83	54 03	3 09
16.	Adhwani	835 06	193.00	23.11	193 00	23.11	38 08	4 56
17.	Kaljikhal	1406 37	375.91	26.73	375.91	26.73	78 07	5.56
18.	Saknikhet	1577.60	335.49	21 26	335.49	21 26	70.36	4.47
19.	Banghat	2180.77	550.10	25.22	550 10	25.22	104.69	4.80
20.	Satpuli	1890.58	391.10	20.69	391.10	20 69	168.94	8.93
21.	Kandarpani	2255 76	486.20	21.55	486.70	21.58	254.70	11 29
22.	Mawadhar	806.36	173.40	21.50	173.40	21.50	80.40	9.97
23.	Patisain	607.96	101.00	16.61	101.00	16.61	76.88	12.65

Crops and Percentage to the Gross Sown Area—1984 (in hectares)

Mandua		Jhangora		Pulses		Vegetables	
Area	Percentage	Area	Percentage	Area	Percentage	Area	Percentage
10	11	12	13	14	15	16	17
268.77	20.53	67 57	5 16	35 77	2.73	35 76	2 73
1169 14	30 91	199 89	5 29	179 93	4.77	179 93	4 77
616 43	21 24	280 23	9 71	159 83	5 48	159 82	5.48
497 19	31 93	160.82	10 32	66 06	4.24	66.05	4 24
571 17	23 50	131 40	5.43	99 15	4 07	99 15	4 07
561 02	27.93	149 24	7.43	127 64	6 35	127.64	6.35
734.62	32.92	108.32	4 85	114 39	5 12	114.38	5 12
610 03	32.39	136 33	7.23	86 99	4 62	86 98	4.62
370 94	24.26	127.79	8.36	77 62	5 08	77 62	5.08
625.07	28.98	247.80	11 49	68.79	3 12	68.78	3 12
241.20	11.46	79 56	3.78	114 07	5 42	114.07	5.42
362.86	26.39	44 12	3.22	46 26	3.36	46 25	3 36
325.90	22.27	38.64	2 64	43.40	2 97	43.40	2.97
335.49	22.09	100 27	6 66	71.37	4 70	71.37	4.70
489.27	28.02	65.83	3.77	82 45	4.72	82.45	4.72
218.90	26.21	46.68	5.59	72.70	8.71	72.70	8.71
359.91	25.59	87.67	6.23	64.45	4.58	64.45	4.58
586.47	37.17	145.95	9.26	51 92	3.29	51.92	3 29
649.33	29.78	137.69	6.32	94.43	4.33	94.43	4.33
479.24	25.35	164.54	8.70	147.83	7.82	147.83	7.82
515 60	22.87	277.10	12 29	117.73	5.21	117.73	5.21
220.70	27.37	45.60	11.86	31.43	3.90	31.43	3.90
197.70	32.51	81.38	13.38	25.00	4.12	25.00	4.12

APPENDIX

1	2	3	4	5	6	7	8	9
24.	Mundneshwar	1858 65	427 40	22 99	427 40	22 99	163 66	8 81
25.	Pipalipani	584.03	113 62	19 46	113 62	19.46	89 07	15 25
26	Jakheti	1211 44	208.46	17 21	208 46	17 21	115 30	9 51
27.	Agiora	1437 82	369 99	25 73	369 94	25 73	250 00	17 39
28	Paidul	1245 55	318 27	25.56	318 27	25.56	61.21	4.92
29.	Paisundakhal	1920 03	480.18	25 00	480 18	25.00	91 73	4 78
30.	Kandara	1013 49	261.02	25.75	261 02	25 75	44 08	4 36
31.	Bubakhal	772 31	168 00	21.75	168.00	21 75	83.15	10 76
32.	Daduadevi	945.90	218 62	23.12	229 10	24 32	64 27	6 79
33.	Pauri	1912.86	605 59	31.66	605.59	31 66	98 95	5 17
34.	Kyark	1958.61	482 35	24 63	482 35	24 63	107 11	5 46
35.	Kirtinagar	1184 22	323 51	27.32	323 51	27 32	65.17	5 50
36.	Srinagar	2050 81	599 80	29.25	599 80	29.25	61 60	3 00
37.	Sumari	2798.21	987.05	35.28	390 65	13 97	193.11	6.91
38	Chaubatiakhal	923.89	203 79	22.06	202 69	21.93	65.08	7.04
39.	Choprium	599 10	112 76	18 82	123 46	20 61	93.00	15 52
40.	Bhainswara	342 51	86 40	25.22	86 40	25.22	14.00	4 08
41.	Sikukhal	873.47	195.44	22.37	195 44	22 37	63.00	7.22
42.	Pokhrikhet	1900.79	322.88	17.51	322 88	17.51	188.00	9.89
43.	Champeshwar	1381.69	338.40	24.49	361.50	26.16	94 64	6.84
44.	Pabau	1422.05	387.72	27.26	410.58	28.87	70.84	4.98
45.	Khirsu	2629 86	728.00	27.67	778.53	29 60	117.83	4.47
46.	Bhattisera	2063.11	638.34	30.94	640.54	31.50	94 24	4.57
47.	Kherakhal	2674.56	754.43	28.20	737 32	27.56	125.34	4.57
48.	Mailisain	1692.30	461.00	27.24	461.00	27.24	134 60	7.95
49.	Chifalghat	1490.58	431 44	28.94	431.44	28 94	62.97	4.22

V 6 . (*Contd.*)

10	11	12	13	14	15	16	17
463 69	24.96	177 20	9.53	99 65	5 36	99 65	5 36
79 06	13 53	98 02	16 78	45 33	7 76	45 32	7.76
440 30	36 35	133 10	10.98	52.92	4 37	52 91	4 37
283 10	19 69	88 90	6 18	37 95	2 64	37.94	2 64
340 59	27 34	81 21	6 52	63 00	5 05	63 00	5 05
474 94	24 73	223 97	11 67	84 52	4 41	84 51	4 41
302 24	29 82	46 48	4 58	49 33	4 87	49 32	4.87
183 78	23 79	96 65	12 51	36 38	4 72	36.35	4.72
267 48	28 27	77 87	8 23	44 28	4 68	44 28	4 68
297 25	15.53	109 95	5 74	97 77	5 12	97 76	5 12
566 93	28.95	136 31	6 97	91 78	4 68	91 78	4 68
296 08	25 00	93 14	7 86	41 41	3 50	41 40	3 50
467 60	22 80	94 10	4.58	113.96	5 56	113 95	5 56
720.57	25 75	243 91	8 71	131 46	4 69	131 46	4 69
288.36	31 21	81 68	8 84	41 15	4.46	41.14	4 46
159.56	26 63	59.50	9 94	25 41	4.24	25.41	4.24
100.29	29.28	15.92	4.66	19.75	5.77	19.75	5.77
281.68	32 25	63 70	7.29	37.11	4.25	37.10	4.25
664.16	34.94	225.20	11.85	78.84	4.15	78.83	4.15
308.43	22.33	131.84	9.54	73.44	5.32	73.44	5.32
310.55	21.84	105.50	7.43	68.43	4.81	68.43	4.81
646.15	24 56	178 33	6.78	91.51	3.46	91 51	3 46
356.92	17.30	266 66	6.14	103.21	5.00	103.20	5.00
658.54	24.54	185.07	6.81	111.92	4.17	111.92	4.17
289.14	17.08	164 30	9.71	91.13	5.39	91.13	5.39
359.45	24.12	88.47	5.93	58.41	3.92	58.40	3.92

APPENDIX

1	2	3	4	5	6	7	8	9
50.	Sankarsain	1448 41	332 63	22 97	332 63	22.97	103.04	7.11
51.	Cholusain	831 48	192 49	23 15	192 49	23.15	59.91	7 20
52	Bajwar	360 94	81 53	22 59	81 53	22 59	27 62	7 65
53	Damdeval	1064.51	212 16	19 93	212 16	19 93	111 53	10 48
54.	Chaunrikhal	364 94	69 03	18 91	69 03	18 91	39 05	10 70
55	Pokhri	320.88	79 00	24.62	79 00	24 62	24 00	7 47
56	Bhira	696.33	159 00	22 84	159 00	22.84	56 00	8 04
57.	Thailisain	2681.55	473 00	17 63	504 00	18 79	381 00	14.21
58	Nautha	1329 70	314 53	23 65	314 53	23 65	80 38	6 05
59	Chakisain	1565 92	427 44	27 30	427 94	27 30	98 35	6 28
60.	Paithani	1058 62	256 28	24.21	200 43	18 93	96 60	9 12
61.	Barsuri	1702.42	445 02	26 14	455.38	26 74	102 90	6 04
62.	Rudraprayag	2367.90	566 72	23 93	566.72	23 93	170 51	7 20
63.	Khankara	790 68	232.50	29 40	240 50	30 42	29 80	3 77
64.	Sumerpur	380.12	59 60	15.67	59 60	15.67	35.62	9.37
65.	Ratura	1346.96	413.55	30.72	413 55	30.72	99.18	7.36
66.	Molkakhal	1037 28	156 95	15.13	201.50	19.42	125 69	12 12
67	Gidokhal	338.79	82.52	24.36	26 46	7.81	36.22	10 69
68	Chaunra	1915.75	482.00	25.16	266 60	13.91	159 73	8 33
69	Gadoli	1318.60	305.62	23.27	320.12	24.27	100 96	8.33
70.	Tarpali	463.15	152.65	32.95	152.65	32.95	18 85	4 07
71.	Bungidhar	4161.78	802.13	19 27	935 66	22.48	481.80	10.14
72.	Samoya	2711 65	481.09	17 74	706.72	26.06	283.25	10.44
	Total	**110725.09**	**27591.45**		**27254.82**		**7738.10**	

V 6 : (*Contd*)

10	11	12	13	14	15	16	17
435 77	30 09	140.54	9 70	51 90	3 58	51 90	3 58
244 36	29 39	72 51	8 73	34 86	4 19	34 86	4 19
105 64	29 26	31 12	8 62	16 75	4 64	16 75	4 64
299 53	28 14	154 03	14 47	35 55	3 34	39 55	3.71
113 68	31 15	46 75	12 81	13 70	3 76	13 70	3.76
77 00	23 99	24.00	7 47	18 95	5.91	18 94	5.91
197 70	28 39	62.30	8.95	31.17	4 47	31 16	4 47
782 22	29 17	449 00	16.74	46 17	1 73	46 16	1 73
421.63	31 71	105 88	7.96	46 38	3.49	46.37	3.49
358.82	22 91	123 55	7.89	65 16	4 16	65 16	4.16
303.60	28 67	109 85	10.37	45.93	4.35	45 93	4 35
430 28	25 28	123 96	7 28	72 44	4.26	72.44	4 26
664.92	28 08	232 47	9 82	83.28	3.52	83 28	3 52
163.20	20.64	44.20	5.59	40.24	5 09	40 24	5 09
96.53	25 39	40 72	10 72	44 03	11.59	44.02	11.59
232.79	17.28	115.38	8.56	36.26	2.68	36.26	2.68
275.16	26 54	207.41	19.99	35.29	3.40	35.28	3 40
48.70	14.37	116 30	24.32	14.30	4.22	14.29	4 22
571 94	29 85	251.23	13.11	92.13	4.82	92.12	4.82
315.60	23 93	168.86	12.80	49.22	3.72	49.22	3 72
92.00	19.86	18.85	4.07	14 08	3.05	14.07	3.05
1068.62	25 68	637.58	15.33	148.00	3.55	147.99	3.55
659.84	24 33	433.65	15.99	73.55	2.72	73.55	2.72
28573 32		**9811.54**		**4878.59**		**4882.27**	

APPENDIX V.7 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
35.	Kirtinagar	807	1297	490	—	818	1348	530	—	206	87	—	119
36.	Shrinagar	2893	6577	3684	—	2742	7161	4419	—	161	462	301	—
37.	Sumari	3383	4028	645	—	3367	4390	1023	—	868	284	—	584
38.	Chaubatiyakhal	1276	2295	1019	—	1274	2502	1228	—	296	161	—	135
39.	Chopriun	762	1918	1156	—	804	2088	1284	—	374	135	—	239
40.	Bhainswara	416	1383	967	—	440	1508	1068	—	58	97	39	—
41.	Sikukhal	845	2354	1509	—	895	2564	1669	1	220	167	—	53
42.	Pokhrikhet	1706	3196	1490	—	1734	3483	1749	—	713	225	—	488
43.	Champeshwar	1548	2879	1331	—	1647	3137	1490	—	308	202	—	106
44.	Pabau	2229	3329	1100	—	2305	3628	1323	—	266	234	—	32
45.	Khirsu	4016	4751	735	—	4212	5177	965	—	493	334	—	159
46.	Bhattisera	2461	2409	—	52	2530	2626	95	—	739	170	—	569
47.	Kherakhal	3054	4893	1839	—	2966	5331	2365	—	404	344	—	60
48.	Mailisain	1311	1940	629	—	1327	2113	786	—	449	136	—	313
49.	Chifalghat	1655	1996	341	—	1643	2175	532	—	131	140	9	—
50	Sankarsain	1274	1824	550	—	1241	1977	736	—	259	128	—	131
51.	Cholusain	1078	1573	495	—	1070	1714	644	—	216	110	—	106
52.	Bajwar	589	979	390	—	576	1076	500	—	114	69	—	45

53. Damdeval	878	1837	959	—	929	2002	1073	—	265	129	—	136
54. Chaunrikhal	431	535	104	—	432	583	151	—	159	42	—	117
55. Pokhri	572	989	417	—	559	1078	519	—	86	71	—	15
56. Bhira	1132	1299	167	—	1111	1405	294	—	223	91	—	132
57. Thailisain	2114	4684	2570	—	2116	5104	2988	—	1303	330	—	973
58. Nautha	1474	2474	1000	—	1476	2895	1419	—	235	175	—	60
59. Chakisain	1647	2417	770	—	1660	2634	974	—	311	171	—	140
60. Paithani	1531	2840	1309	—	1558	3075	1537	—	351	200	—	151
61. Barsuri	1840	3815	1975	—	1892	4157	2265	—	348	269	—	79
62. Rudraprayag	2443	4065	1622	—	2444	4430	1986	—	694	286	—	408
63. Khankara	1177	1040	—	137	1147	1094	—	53	89	71	—	18
64 Sumerpur	543	620	77	—	508	676	168	—	135	48	—	87
65. Ratura	1852	2309	457	—	1794	2517	723	—	310	162	—	148
66. Molkakhal	1019	2104	1085	—	1184	2292	1108	—	535	148	—	387
67. Gidokhal	205	536	331	—	238	583	345	—	87	43	—	44
68. Chaunra	1892	3728	1836	—	2278	4062	1784	—	395	261	—	134
69. Gadoli	1514	2477	963	—	1587	2699	1112	—	263	275	12	—
70. Tarpali	828	970	142	—	828	1057	229	—	75	68	—	7
71. Bungidhar	4068	5385	1317	—	4798	5802	1004	—	1140	374	—	766
72. Samoya	2352	1798	—	554	2505	1959	—	546	825	126	—	699
Total	**130823**	**180808**	**58705**	**8720**	**73083**	**197335**	**71484**	**4825**	**26326**	**12828**	**980**	**14478**

APPENDIX V.7 : (*Contd.*)

S No.	Name of Cluster	Mandua				Jhangora				Pulses			
		Production	Consumption	Deficit	Surplus	Production	Consumption	Deficit	Surplus	Production	Consumption	Deficit	Surplus
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Bahbazar	934	512	—	422	236	131	—	105	109	268	159	—
2.	Ghindwara	3215	1407	—	1808	552	241	—	311	505	685	180	—
3.	Baganikhal	2600	935	—	1665	677	249	—	428	407	493	86	—
4.	Diusi	1260	498	—	762	407	161	—	246	180	275	95	—
5	Ghandiyal	1690	914	—	776	386	170	—	216	224	451	227	—
6.	Kanskhet	1459	984	—	475	389	261	—	128	180	518	338	—
7.	Nahsain	1805	1282	—	523	270	190	—	80	246	613	367	—
8.	Safdarkhal	1748	1206	—	542	411	275	—	136	233	617	384	—
9.	Kamalpur	841	798	—	43	301	275	—	26	95	446	351	—
10.	Jamlakhal	651	952	301	—	671	370	—	301	257	541	284	—
11.	Delechaunri	—	1513	—	256	—	373	—	—	—	784	522	—
12	Khandiunsain	1413	1075	—	338	176	131	—	45	209	502	293	—
13.	Kot	1350	1412	62	—	172	167	—	5	256	453	197	—
14.	Kholchaunri	1182	832	—	350	289	239	—	50	150	416	296	—

15. Lwali	1252	950	—	302	173	128	—	45	179	450	271	—
16. Adhwani	669	407	—	262	145	87	—	58	79	205	126	—
17. Kaljikhal	1443	925	—	518	384	226	—	158	212	479	267	—
18. Sakpikhet	909	439	—	470	275	145	—	130	144	242	98	—
19. Banghat	1440	816	—	624	321	173	—	148	212	412	200	—
20. Satpuli	1721	529	—	1192	623	182	—	441	263	296	33	—
21. Kandarpani	1828	816	—	1012	955	439	—	516	294	526	232	—
22. Mawadhar	671	335	—	336	292	145	—	147	99	200	101	—
23. Patisain	679	369	—	310	259	155	—	104	78	218	140	—
24. Mundneshwar	1822	856	—	966	684	326	—	358	232	492	260	—
25. Pipalipani	1158	698	—	460	380	231	—	149	137	386	249	—
26. Jakheti	1361	793	—	568	413	239	—	174	177	429	252	—
27. Agrora	985	675	—	310	506	212	—	294	148	368	220	—
28. Paidul	860	718	—	142	248	174	—	74	136	371	235	—
29. Parsundakhal	1538	1180	—	358	614	555	—	59	221	722	501	—
30. Kandara	748	904	156	—	165	169	4	—	123	447	324	—
31. Bubakhal	765	348	—	417	330	182	—	148	141	219	78	—
32. Dadua Devi	554	544	—	10	326	125	—	201	123	278	155	—
33. Pauri	1937	5181	3244	—	431	1145	714	—	273	2631	2358	—
34. Kyark	1508	1023	—	485	361	241	—	120	259	526	267	—

APPENDIX V.7 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
35.	Kirtinagar	717	456	—	261	224	143	—	81	103	250	147	—
36.	Shrinagar	851	2650	1799	—	174	538	364	—	122	1324	1202	—
37.	Sumari	2853	1454	—	1399	970	495	—	475	342	809	467	—
38.	Chaubatiyakhal	499	879	380	—	278	232	—	46	160	463	303	—
39.	Chopriun	582	676	94	—	235	252	17	—	70	386	316	—
40.	Bhainswara	391	576	185	—	63	93	30	—	77	279	202	—
41.	Sikukhal	1035	929	—	106	235	211	—	24	124	474	350	—
42.	Pokhrikhet	2563	1155	—	1408	832	393	—	439	278	644	366	—
43.	Champeshwar	1001	980	—	21	426	415	—	11	169	579	410	—
44.	Pabau	1117	1203	86	—	384	409	25	—	217	671	454	—
45.	Khirsu	2343	1804	—	539	654	496	—	158	326	946	620	—
46.	Bhattisera	1066	862	—	204	377	305	—	72	236	485	249	—
47.	Kherakhal	2058	1848	—	210	582	521	—	61	283	984	701	—
48.	Mailisain	853	599	—	254	488	340	—	148	209	390	181	—
49.	Chifalghat	685	775	90	—	166	191	25	—	142	401	259	—
50.	Sankarsain	875	672	—	203	282	217	—	65	124	366	242	—
51.	Cholusain	777	585	—	192	235	177	—	58	125	316	191	—
52.	Bajwar	411	366	—	45	123	108	—	15	65	197	132	—

53.	Damdeval	556	588	32	—	288	302	14	—	134	370	236	—
54.	Chaunrikhal	415	196	—	219	172	63	—	109	63	108	45	—
55.	Pokhri	300	366	66	—	94	113	19	—	54	199	145	—
56.	Bhira	772	474	—	298	243	150	—	93	121	260	139	—
57.	Thailisain	2612	1441	—	1171	1545	827	—	718	102	943	841	—
58	Nautha	1013	958	—	55	257	240	—	17	189	498	309	—
59.	Chakisain	1018	889	—	129	338	305	—	33	166	137	321	—
60.	Paithani	1154	1010	—	144	421	365	—	56	169	582	413	—
61.	Barsuri	462	1393	931	—	405	454	49	—	213	769	556	—
62.	Rudraprayag	2137	1463	—	674	742	505	—	237	259	819	560	—
63.	Khankara	487	383	—	104	132	103	—	29	88	202	114	—
64.	Sumerpur	350	212	—	138	147	89	—	58	171	126	—	45
65.	Ratura	684	747	63	—	338	371	33	—	170	466	296	—
66.	Molkakhal	972	581	—	391	735	438	—	297	141	424	283	-
67.	Gidokhal	140	77	—	63	229	183	—	46	31	108	77	—
68.	Chaunra	1422	1284	—	138	552	621	69	—	231	751	520	—
69.	Gadoli	58	885	827	—	390	314	—	76	162	499	337	—
70.	Tarpali	432	390	—	42	85	80	—	5	74	195	121	—
71.	Bungidhar	2889	1717	—	1172	1460	860	—	600	429	1072	643	—
72.	Samoya	1874	556	—	1318	1064	314	—	750	237	362	125	—
	Total	**86189**	**66905**	**8316**	**27600**	**29612**	**20745**	**1363**	**10230**	**13219**	**36193**	**23019**	**45**

APPENDIX V.8 : PAURI TEHSIL : PRODUCTION, CONSUMPTION AND SURPLUS/DEFICIT OF FOOD GRAINS—1984 (in Quintals)

S. No.	Name of Cluster	Rice				Wheat				Barley			
		Production	Consumption	Surplus	Deficit	Production	Consumption	Surplus	Deficit	Production	Consumption	Surplus	Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Bahbazar	4237	1486	2751	—	4666	1542	3124	—	283	100	183	—
2.	Ghindwara	9986	3541	6445	—	11355	3859	7496	—	798	249	549	—
3.	Baganikhal	7122	2607	4515	—	7912	2841	5071	—	960	284	676	—
4.	Diusi	3134	1453	1681	—	3460	1581	1879	—	602	102	500	—
5.	Ghandiyal	5863	2385	3478	—	6567	2600	3967	—	534	168	366	—
6.	Kanskhet	4495	2741	1754	—	4966	2752	2214	—	555	193	362	—
7.	Nahasain	5772	3256	2516	—	6325	3548	2777	—	413	229	184	—
8.	Safdarkhal	3577	3265	312	—	4001	3558	443	—	530	230	300	—
9.	Kamalpur	3245	2420	825	—	3630	2572	1058	—	315	166	149	—
10.	Jamalkhal	5441	2862	2579	—	5965	3119	2846	—	850	201	649	—
11.	Delchauri	6182	4194	1988	—	6898	4529	2369	—	591	93	498	—
12.	Khandiunsain	3856	2658	1198	—	4250	2896	1354	—	201	187	14	—
13.	Kot	5987	3457	2530	—	5877	3767	2110	—	182	143	39	—
14.	Kholchaunri	4345	2358	1987	—	4830	2570	2260	—	375	166	209	—

15. Lwali	4017	2371	1646	—	4500	2585	1915	—	254	167	87	—
16. Adhwani	2081	1089	992	—	717	1186	—	469	179	77	102	—
17. Kaljikhal	3204	2534	670	—	3579	2761	818	—	367	179	188	—
18. Saknikhet	3094	1284	1810	—	3432	1599	1833	—	331	91	240	—
19. Banghat	4652	2178	2474	—	5281	2373	2908	—	502	153	349	—
20. Satpuli	3021	1573	1448	—	3407	1713	1694	—	794	110	684	—
21. Kandarpani	4708	2786	1922	—	5206	3035	2171	—	1197	196	1001	—
22. Mawadhar	1203	1057	146	—	1371	1152	219	—	378	75	303	—
23. Patisain	620	1157	—	537	717	1261	—	544	361	82	279	—
24. Mandeshwar	3244	2603	641	—	3664	2835	829	—	769	184	585	—
25. Pipalpani	697	2046	—	1349	807	2229	—	1422	429	144	285	—
26. Jakheti	1496	2270	—	774	1761	2474	—	713	542	159	383	—
27. Agrora	2892	1907	985	—	3257	2079	1178	—	1175	134	1041	—
28. Paidul	3562	1962	1600	—	3775	2138	1637	—	287	138	149	—
29. Parsundakhal	3982	3815	167	—	4459	4166	293	—	432	269	163	—
30. Kandara	2223	2362	—	139	2483	2574	—	91	207	166	41	—
31. Bubakhal	1031	1164	—	133	1193	1258	—	65	390	82	308	—
32. Dadua Devi	2031	1469	562	—	2327	1600	727	—	302	103	199	—
33. Pauri	6752	13925	—	7173	7380	15177	—	7797	465	978	—	513
34. Kyark	4409	2622	1787	—	4895	2856	2039	—	503	185	318	—

APPENDIX V.8 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
35.	Kirtinagar	2400	1321	1079	—	2717	1437	1280	—	306	93	213	—
36.	Srinagar	6337	6992	—	655	6953	7619	—	666	290	491	—	201
37.	Samari	8156	4827	3329	—	4901	5260	—	359	898	339	559	—
38.	Chaubatikhal	1665	2387	—	722	1860	2601	—	741	306	169	137	—
39.	Choprium	1564	2042	—	478	1717	2225	—	508	438	143	295	—
40.	Bhainswara	530	1473	—	943	613	1604	—	991	66	104	—	38
41.	Sikukhal	1199	2508	—	1309	1397	2732	—	1335	297	177	120	—
42.	Pokhrikhet	3009	3406	—	397	3343	3712	—	369	884	216	668	—
43.	Champeshwar	3670	3067	603	—	4184	3351	833	—	445	239	206	—
44.	Pabau	4186	3558	628	—	4749	3876	873	—	333	250	83	—
45.	Khirsu	7055	5052	2003	—	8152	5456	2696	—	554	355	199	—
46.	Bhattisera	5035	2568	2467	—	5682	2798	2884	—	443	181	262	—
47.	Kherakhal	6279	5220	1059	—	6908	5688	1220	—	589	367	222	—
48	Mailisain	3864	2065	1799	—	4323	2250	2073	—	633	145	488	—
49.	Chifalghat	3889	2078	1811	—	4324	2264	2060	—	296	146	150	—
50.	Sankarsain	3145	1933	1212	—	3482	2096	1386	—	485	136	349	—
51.	Cholusain	2147	1676	471	—	2347	1827	520	—	282	117	165	—
52.	Bajwar	914	1043	—	129	999	1136	—	137	130	74	56	—

53.	Damdeval	1303	1958	—	655	1506	2133	—	627	525	138	387	—
54.	Chaunrikhal	562	570	—	8	630	620	10	—	185	45	140	—
55.	Rokhri	961	1124	—	163	1044	1140	—	96	113	75	38	—
56.	Bhira	1804	1379	425	—	1969	1503	466	—	263	97	166	—
57.	Thailisain	5933	4991	942	—	6588	5439	1149	—	1791	350	1441	—
58.	Nautha	3379	2635	744	—	3703	2872	831	—	378	186	192	—
59	Chakisain	4072	2575	1497	—	4509	2805	1704	—	462	182	280	—
60.	Raithani	2884	3025	—	141	2753	3297	—	544	455	212	243	—
61.	Barsuri	4248	4065	183	—	4773	4430	343	—	484	286	198	—
62.	Rudraprayag	4846	4322	524	—	5410	4709	701	—	802	304	498	—
63.	Khankara	2434	1069	1365	—	2730	1165	1565	—	140	76	64	—
64.	Sumerpur	717	661	56	—	780	721	59	—	167	47	120	—
65.	Ratura	4732	2461	2271	—	5162	2681	2481	—	466	174	292	—
66.	Molkakhal	2163	2242	—	79	2593	2443	150	—	591	158	433	—
67.	Gidokhal	506	571	—	65	188	622	—	434	170	45	125	—
68.	Chaunra	4305	3961	344	—	3258	4316	—	1058	751	279	472	—
69.	Gadoli	3014	2622	392	—	3428	2856	572	—	517	185	332	—
70.	Tarpali	1351	1034	317	—	1559	1126	433	—	89	74	15	—
71.	Bungidhar	7680	5683	1997	—	9888	6193	3695	—	1983	135	1848	—
72.	Samoya	3649	1918	1731	—	7358	2090	5268	—	1331	400	931	—
	Total	**257748**	**192939**	**80658**	**15849**	**283393**	**209878**	**92481**	**18966**	**36391**	**13373**	**23770**	**752**

APPENDIX V.8 : (*Contd*)

S. No.	Name of the Cluster	Mandua				Jhangora				Pulses			
		Production	Consumption	Surplus	Deficit	Production	Consumption	Surplus	Deficit	Production	Consumption	Surplus	Deficit
1	2	15	16	17	18	19	20	21	22	23	24	25	26
1.	Bahbazar	1317	547	770	—	333	139	194	—	175	285	—	110
2.	Ghindwara	5729	1464	4265	—	983	250	733	—	778	713	65	—
3.	Baganikhal	3020	997	2023	—	1379	265	1114	—	780	525	255	—
4.	Diusi	2436	531	1905	—	791	172	619	—	322	293	29	—
5.	Ghandiyal	2799	975	1824	—	646	181	465	—	484	481	3	—
6.	Kanskhet	2749	1048	1701	—	734	279	455	—	623	551	72	—
7.	Nahsain	3600	1374	2226	—	533	203	330	—	558	656	—	98
8.	Safdarkhal	2989	1287	1702	—	671	294	377	—	425	658	—	233
9.	Kamalpur	1818	850	968	—	629	293	336	—	379	476	—	97
10.	Jamlakhal	3062	992	2070	—	1219	394	825	—	336	577	—	241
11.	Delchauri	1182	1614	—	432	392	398	—	6	556	837	—	281
12.	Khandiunsain	1778	1151	627	—	218	141	77	—	225	535	—	310
13.	Kot	1597	1497	100	—	190	177	13	—	212	695	—	483
14.	Kholchaunri	1644	887	757	—	493	255	238	—	348	475	—	127
15.	Lwali	2397	1011	1386	—	324	137	187	—	402	508	—	106

16. Adhwani	1073	434	639	—	229	90	139	—	359	219	140	—
17. Kaljikhal	1764	986	788	—	431	240	191	—	314	510	—	196
18. Saknikhet	2873	467	2406	—	718	154	564	—	254	259	—	5
19. Banghat	3182	870	2312	—	677	185	492	—	461	439	22	—
20. Satpuli	2348	566	1782	—	811	195	616	—	721	316	405	—
21. Kandarpani	2526	877	1649	—	1364	471	893	—	575	561	14	—
22. Mawadhar	1082	357	725	—	220	155	65	—	153	212	—	59
23. Patisain	969	395	574	—	400	165	235	—	122	233	—	111
24. Mundneshwar	2272	912	1360	—	872	348	524	—	486	524	—	38
25. Pipalpani	387	767	—	380	482	254	228	—	222	412	—	190
26. Jakheti	2158	844	1314	—	655	255	400	—	259	457	—	198
27. Agrora	1388	702	686	—	438	221	217	—	185	384	—	199
28. Paidul	1669	764	905	—	399	185	214	—	307	394	—	87
29. Parsundakhal	2328	1259	1069	—	1102	592	510	—	413	770	—	357
30. Kandara	1481	964	517	—	228	180	48	—	241	476	—	235
31. Bubakhal	901	370	531	—	475	194	281	—	173	235	—	62
32. Daduadevi	1310	578	732	—	383	133	250	—	216	296	—	80
33. Pauri	1436	5517	—	4081	541	1219	—	678	477	2802	—	2325
34. Kyark	2778	1027	1751	—	671	242	429	—	448	528	—	80
35. Kirtinagar	1450	486	964	—	459	152	307	—	202	266	—	64

APPENDIX V 8 : (*Contd.*)

1	2	15	16	17	18	10	20	1	2	3	2n	25	26
36.	Srinagar	2291	2813	—	522	463	572	—	109	556	1407	—	851
37.	Sumari	3531	1845	1686	—	1200	593	607	—	641	992	—	351
38.	Chuabatiakhal	1413	915	409	—	402	241	161	—	201	481	—	280
39.	Choprium	782	720	62	—	293	269	24	—	124	411	—	287
40.	Bhainswara	491	613	—	122	78	100	—	22	97	197	—	100
41.	Sikukhal	1380	990	390	—	314	224	90	—	182	505	—	323
42.	Pokrikhet	3255	1230	2025	—	1108	418	690	—	385	686	—	301
43.	Champeshwar	1511	1042	469	—	648	442	206	—	358	618	—	260
44	Pabau	1522	1235	287	—	520	437	83	—	334	716	—	382
45.	Khirsu	3166	1921	1245	—	878	529	349	—	447	1019	—	572
46.	Bhattsera	1749	918	831	—	623	326	297	—	504	517	—	13
47.	Kherakhal	3227	1969	1258	—	910	555	355	—	547	1051	—	504
48.	Mailisain	1417	639	778	—	809	362	447	—	445	417	28	—
49.	Chifalghat	1761	807	954	—	435	299	136	—	285	419	—	134
50.	Sankarsain	2135	707	1428	—	692	228	464	—	254	389	—	135
51.	Cholusain	1198	623	575	—	357	189	168	—	170	338	—	168
52.	Bajwar	517	389	128	—	154	115	39	—	82	209	—	127
53	Damdeval	1468	625	843	—	758	321	437	—	173	394	—	221

54.	Chaunrikhal	557	209	348	—	230	67	163	—	67	115	—	48
55.	Pokhri	377	390	—	13	118	121	—	3	93	212	—	119
56.	Bhira	969	508	461	—	307	160	147	—	152	277	—	125
57.	Thailisain	3833	1535	2298	—	2209	881	1328	—	225	1005	—	780
58.	Nautha	2066	1019	1047	—	521	256	265	—	226	530	—	304
59.	Chakisain	1758	927	831	—	608	319	289	—	318	519	—	201
60.	Paithani	1488	1075	413	—	540	389	151	—	224	610	—	386
61.	Barsuri	2108	1484	624	—	610	483	127	—	353	819	—	466
62.	Rudraprayag	3259	1555	1704	—	1145	537	608	—	406	870	—	464
63.	Khankara	800	408	392	—	217	110	107	—	196	215	—	19
64.	Sumerpur	473	225	248	—	201	95	106	—	215	134	81	—
65.	Ratura	1141	796	345	—	568	395	173	—	177	495	—	318
66.	Molkakhal	1348	619	729	—	1020	466	554	—	172	451	—	279
67.	Gidokhal	239	82	157	—	573	194	379	—	70	115	—	45
68.	Chaunra	2803	1357	1446	—	1236	659	577	—	450	790	—	340
69.	Gadoli	1546	944	602	—	830	334	496	—	240	528	—	288
70.	Tarpali	451	415	36	—	92	85	7	—	68	208	—	140
71.	Bungidhar	5236	1832	3404	—	3137	918	2219	—	722	1145	—	423
72.	Samoya	3233	593	2640	—	2133	235	1798	—	359	387	—	28
	Total	**139991**	**71341**	**74200**	**5550**	**48027**	**22232**	**26613**	**818**	**23709**	**38749**	**1114**	**16154**

APPENDIX VI 1 : PAURI TEHSIL . ESTIMATED REQUIREMENT OF SEEDS—1979 (in quintals)

S. No.	Name of Cluster	Paddy	Wheat	Barley	Mandua	Jhangora	Pulses	Vegetables
1	2	3	4	5	6	7	8	9
1.	Bahbazar	54	144	48	24	5	3	2
2	Ghindwara	439	752	120	83	11	15	8
3.	Baganikhal	269	442	139	67	14	2	1
4.	Diusi	167	261	91	32	8	6	3
5.	Ghandiyal	197	318	79	43	8	7	3
6	Kanskhet	172	296	79	37	8	5	3
7.	Nahsain	251	406	55	46	5	8	4
8.	Safdarkhal	217	312	84	54	8	7	4
9	Kamlapur	82	132	42	21	6	3	1
10	Jamlakhal	134	357	130	17	14	8	4
11.	Delchaunri	242	369	86	45	9	8	4
12.	Khandiunsain	230	339	36	36	3	6	3
13.	Kot	250	402	35	34	3	8	4
14.	Kholchaunri	109	210	59	20	6	4	2
15.	Lwali	185	366	35	32	3	5	3
16.	Adhwani	50	93	30	17	3	2	1
17.	Kaljikhal	187	270	78	37	8	6	3
18.	Saknikhet	125	212	56	23	6	4	2
19.	Banghat	180	311	65	37	6	6	3
20.	Satpuli	195	276	127	44	13	8	4
21.	Kandarpani	213	332	195	47	19	9	4
22.	Mawadhar	90	127	60	17	6	3	1
23.	Patisain	56	72	53	17	5	2	1
24.	Mundneshwar	215	294	140	47	14	7	3

APPENDIX VI.1 : (*Contd.*)

1	2	3	4	5	6	7	8	9
25.	Pipalpani	79	102	78	30	8	4	2
26.	Jakhcti	120	178	84	35	8	5	3
27	Agrora	227	315	198	25	2	4	2
28	Paidul	111	219	51	22	5	4	2
29.	Parsundakhal	297	417	54	39	12	7	3
30.	Kandara	118	181	34	19	3	4	2
31.	Bubakhal	118	151	67	20	7	4	2
32.	Daduadevi	100	161	67	14	7	4	2
33.	Pauri	233	446	88	50	9	8	4
34.	Kyark	319	463	74	39	7	8	4
35.	Kirtinagar	82	123	46	18	5	3	2
36.	Srinagar	111	297	36	22	4	4	2
37.	Sumari	229	531	193	73	20	10	5
38.	Chaubatiakhal	116	182	66	13	6	5	2
39.	Choprium	52	107	83	15	5	2	1
40.	Bhainswara	60	78	13	10	1	2	1
41.	Sikukhal	123	158	49	26	5	4	2
42.	Pokhrikhet	178	263	158	66	17	9	4
43.	Champeshwar	119	226	68	26	9	5	3
44.	Pabau	158	306	59	29	8	7	3
45.	Khirsu	298	569	109	60	13	10	5
46.	Bhattisera	274	395	75	27	8	7	4
47.	Kherakhal	270	418	90	53	12	9	4
48.	Mailisain	132	199	100	22	10	6	3
49.	Chifalghat	135	226	54	17	4	4	2
50.	Sankarsain	80	155	58	22	6	4	2

APPENDIX VI 1 : (*Contd*)

1	2	3	4	5	6	7	8	9
51.	Cholusain	87	146	48	20	5	4	2
52.	Bajwar	39	73	25	10	3	2	1
53.	Damdeval	127	164	59	14	6	4	2
54.	Ckaunrikhal	39	62	35	11	4	2	1
55.	Pokhri	38	71	19	8	2	2	1
56.	Bhira	82	143	50	20	5	4	2
57.	Thailisain	211	282	290	67	31	3	2
58.	Nautha	133	211	52	26	5	6	3
59.	Chakisain	158	243	69	26	7	5	3
60.	Paithani	141	225	78	30	9	5	3
61.	Barsuri	162	270	78	37	8	7	3
62.	Rudraprayag	218	348	152	55	15	8	4
63.	Khankara	36	121	20	13	3	3	1
64.	Sumerpur	11	54	30	9	3	5	3
65.	Ratura	108	219	69	18	7	5	3
66.	Molkakhal	60	155	119	25	15	4	2
67.	Gidokhal	30	41	19	4	7	1	1
68.	Chaunra	124	310	88	36	11	7	3
69.	Gadoli	133	227	58	2	8	5	2
70.	Tarpali	74	118	17	11	2	2	1
71.	Bungidhar	412	738	253	75	30	13	7
72	Samoya	231	375	183	48	22	7	4
	Total	**11102**	**18456**	**5765**	**2233**	**587**	**389**	**196**

APPENDIX VI 2 : PAURI TEHSIL : ESTIMATED REQUIREMENT OF SEEDS—1984 (in quinta's)

S. No.	Name of Cluster	Paddy	Wheat	Barley	Mandua	Jhangora	Pulses	Vege-tables
1	2	3	4	5	6	7	8	9
1.	Bahbazar	186	378	48	27	5	4	2
2.	Ghindwara	385	447	136	117	16	22	11
3.	Baganikhal	355	675	164	62	22	19	9
4.	Diusi	147	287	103	50	13	8	4
5.	Ghandiyal	396	637	91	57	11	12	6
6.	Kanskhet	216	416	95	56	12	15	8
7	Nahsain	213	482	70	73	9	14	7
8.	Safdarkhal	235	383	90	61	11	10	5
9.	Kamalpur	234	363	54	37	10	9	5
10.	Jam'akhal	127	438	144	63	20	8	4
11.	Delchaunri	384	643	100	24	6	14	7
12.	Khandiunsain	211	375	34	36	3	6	3
13.	Kot	255	438	31	33	3	5	3
14.	Kholchaunri	186	384	64	33	8	9	4
15.	Lwali	273	437	43	49	5	10	5
16.	Adhwani	77	173	30	22	4	5	2
17.	Kaljikhal	205	338	62	36	7	8	4
18.	Saknikhet	167	302	56	59	12	6	3
19.	Banghat	302	495	84	65	11	11	6
20.	Satpuli	233	352	135	48	13	18	9
21.	Kandarpani	228	438	204	52	22	14	7
22.	Mawadhar	112	156	64	22	8	4	2
23.	Patisain	71	91	62	20	7	3	1
24.	Mundneshwar	259	385	131	46	14	12	6

APPENDIX VI 2 : (*Contd.*)

1	2	3	4	5	6	7	8	9
25.	Pipalpani	80	102	71	8	8	5	3
26.	Jakheti	218	187	92	44	11	6	3
27.	Agrora	218	333	200	28	7	5	2
28.	Paidul	116	386	49	34	7	8	4
29.	Parsundakhal	269	432	73	47	18	10	5
30.	Kandara	142	235	35	30	4	6	3
31.	Bubakhal	118	151	67	18	8	9	2
32.	Daduadevi	108	206	51	27	6	5	3
33.	Pauri	226	545	79	50	9	12	6
34	Kyark	243	434	86	57	11	11	5
35.	Kirtinagar	199	291	52	30	7	5	2
36.	Srinagar	247	540	49	47	8	14	7
37.	Sumari	554	352	154	72	20	16	8
38.	Chaubatiakhal	116	182	52	29	6	5	2
39.	Choprium	30	111	74	16	5	3	1
40.	Bhainswara	61	78	11	10	2	2	1
41.	Sikukhal	137	167	50	28	5	4	2
42.	Pokhrikhet	170	300	150	66	18	9	5
43.	Champeshwar	133	325	76	31	11	9	4
44.	Pabau	154	370	57	31	8	8	4
45.	Khirsu	341	701	94	65	14	11	5
46.	Bhattisera	374	576	75	36	10	12	6
47.	Kherakhal	421	664	100	66	15	13	7
48	Mailisain	255	415	108	29	13	11	5
49.	Chifalghat	221	388	50	36	7	7	3
50.	Sankarsain	161	299	82	44	11	6	3

APPENDIX VI 2 : (*Contd*)

1	2	3	4	5	6	7	8	9
51.	Cholusain	72	173	48	24	6	4	2
52.	Bajwar	30	73	22	11	2	2	1
53.	Damdeval	148	191	89	30	12	5	2
54	Chaunrikhal	39	62	31	11	4	2	1
55.	Pokhri	24	71	19	8	2	2	1
56.	Bhira	57	143	45	20	5	4	2
57.	Thailisain	41	454	305	78	36	6	3
58.	Nautha	126	283	64	42	8	6	3
59.	Chakisain	205	385	79	36	10	8	4
60.	Paithani	94	180	77	30	9	6	3
61.	Barsuri	213	410	82	43	10	9	4
62.	Rudraprayag	305	510	136	66	17	10	5
63.	Khankara	97	216	24	16	4	5	2
64.	Sumerpur	19	54	29	10	3	5	3
65	Ratura	146	372	79	23	9	4	2
66.	Molkakhal	42	181	101	28	17	4	2
67.	Gidokhal	58	24	29	5	9	2	1
68.	Chaunra	247	240	128	57	2	11	5
69.	Gadoli	140	288	88	32	14	6	3
70.	Tarpali	80	82	15	9	2	2	1
71.	Bungidhar	381	392	337	107	51	18	9
72.	Samoya	82	186	227	66	35	9	4
	Total	**13415**	**31991**	**6186**	**2879**	774	588	288

APPENDIX VI 3 : PAURI TEHSIL : ESTIMATED FERTILISER REQUIREMENT—1979 (in quintals)

S.No	Name of Cluster	N	P	K
1	2	3	4	5
1.	Bahbazar	101	80	55
2.	Ghindwara	466	418	181
3.	Baganikhal	272	241	90
4.	Diusi	156	144	53
5.	Ghandiyal	194	178	68
6.	Kanskhet	185	164	72
7.	Nahsain	247	228	89
8.	Safdarkhal	183	174	51
9.	Kamalpur	82	75	30
10.	Janilakhal	243	198	131
11.	Saknikhet	221	206	71
12.	Khandiunsain	199	188	60
13.	Kot	259	232	100
14.	Kholchaunri	132	116	56
15.	Lwali	155	148	45
16	Adhwani	61	54	25
17.	Kaljikhal	157	150	50
18.	Delchaunri	131	118	51
19.	Banghat	194	174	75
20.	Satpuli	200	187	68
21.	Kandarpani	199	184	67
22.	Mawadhar	73	70	20
23.	Patisain	40	40	8
24.	Mundneshwar	168	164	42

APPENDIX VI.3 : (*Contd*)

1	2	3	4	5
25.	Pipalpani	56	56	11
26.	Jakheti	104	98	32
27.	Agrora	180	174	47
28.	Paidul	143	122	65
29.	Parsundakhal	241	232	64
30.	Kandara	109	102	35
31.	Bubakhal	84	84	17
32.	Daduadevi	93	87	30
33.	Pauri	285	248	125
34.	Kyark	271	258	40
35.	Kirtinagar	74	70	13
36.	Srinagar	205	164	107
37.	Sumari	307	294	43
38.	Chaubatiakhal	111	102	14
39.	Choprium	64	57	21
40.	Bhainswara	44	44	1
41.	Sikukhal	88	88	2
42.	Pokhrikhet	155	146	26
43.	Champeshwar	133	120	38
44.	Pabau	187	166	58
45.	Khirsu	342	304	102
46.	Bhattisera	230	219	32
47.	Kherakhal	259	236	63
48.	Mailisain	119	112	22
49.	Chifalghat	139	126	38
50.	Sankarsain	101	88	37

APPENDIX VI 3 : (*Contd.*)

1	2	3	4	5
51.	Cholusain	91	82	25
52.	Bajwar	46	40	16
53.	Damdeval	92	92	2
54	Chaunrikhal	37	34	9
55.	Pokhri	46	40	16
56.	Bhira	91	80	31
57.	Thailisain	177	158	54
58.	Nautha	128	118	30
59.	Chakisain	146	136	30
60.	Paithani	135	125	30
61.	Barsuri	162	149	38
62.	Rudraprayag	210	194	51
63.	Khankara	84	66	46
64.	Sumerpur	37	30	20
65.	Ratura	141	122	57
66.	Molkakhal	78	76	31
67.	Gidokhal	23	23	5
68.	Chaunra	172	153	54
69.	Gadoli	134	123	32
70.	Tarpali	72	66	17
71.	Bungidhar	400	378	69
72.	Samoya	216	202	41
	Total	**11160**	**10215**	**3345**

APPENDIX VI 4 : PAURI TEHSIL—ESTIMATED FERTILISER REQUIREMENT—1984 (in quintals)

S No	Name of Cluster	N	P	K
1	2	3	4	5
1.	Bahbazar	246	210	98
2.	Ghindwara	563	472	247
3.	Baganıkhal	410	375	152
4.	Dıusi	185	160	69
5.	Ghandiyal	387	354	92
6.	Kanskhet	268	232	78
7.	Nahsain	322	268	146
8.	Safdarkhal	233	212	59
9.	Kamalpur	219	203	47
10.	Jamlakhal	294	242	145
11.	Saknikhet	397	358	109
12.	Khandiunsaın	238	209	76
13.	Kot	320	269	139
14.	Kholchaunrı	253	216	102
15.	Lwali	266	244	63
16.	Adhwani	117	98	53
17.	Kaljıkhal	207	188	54
18.	Delchaunri	190	196	62
19.	Banghat	306	277	78
20.	Satpuli	209	196	39
21.	Kandarpani	281	244	102
22.	Mawadhar	152	86	10
23.	Patisain	50	50	1
24.	Mundneshwar	227	214	39

APPENDIX VI.4 : (*Contd.*)

1	2	3	4	5
25.	Pipalpani	56	56	1
26.	Jakheti	110	104	18
27	Agrora	199	186	39
28.	Paidul	174	158	95
29	Parsundakhal	264	242	63
30.	Kandara	145	132	38
31	Bubakhal	84	84	2
32.	Daduadevi	127	112	41
33.	Pauri	368	302	178
34.	Kyark	273	242	87
35.	Kirtinagar	171	162	27
36.	Srinagar	359	300	156
37.	Sumari	390	345	123
38.	Chaubatiakhal	111	102	25
39.	Choprium	79	61	48
40.	Bhainswara	44	44	1
41.	Sikukhal	98	98	2
42	Pokhrikhet	187	166	58
43.	Champeshwar	210	176	93
44.	Patau	239	200	105
45.	Khirsu	433	307	154
46.	Bhattisera	345	321	69
47.	Kherakhal	410	374	101
48.	Mailisain	254	232	63
49.	Chifalghat	243	216	75
50.	Sankarsain	190	166	66

APPENDIX VI 4. (*Contd*)

1	2	3	4	5
51	Cholusain	117	96	57
52.	Bajwar	49	40	24
53.	Damdeval	106	106	2
54.	Chaunrikhal	37	34	8
55.	Pokhri	51	40	28
56	Bhira	98	80	48
57.	Thailisain	310	246	173
58	Nautha	189	158	85
59	Chakisain	245	214	86
60.	Paithani	144	116	76
61.	Barsuri	258	225	90
62	Rudraprayag	312	284	84
63.	Khakhara	141	120	59
64.	Sumerpur	37	30	20
65.	Ratura	254	208	129
66.	Molkakhal	117	93	66
67.	Gidokhal	28	28	—
68.	Chaunra	216	188	78
69.	Gadoli	182	156	68
70.	Tarpali	85	76	25
71.	Bungidhar	495	435	165
72.	Samoya	338	298	112
	Total	**15732**	**13732**	**5293**

APPENDIX VI 5 : PAURI TEHSIL : ESTIMATED REQUIREMENT OF PESTICIDES—1979

S. No.	Name of Cluster	Parathion (in litres)	Endrin (in litres)	D.D.T. (in Kg.)	B H.C. (in Kg.)	Aldrin (in Kg.)	Nicotine (in litres)
1	2	3	4	5	6	7	8
1	Bahbazar	37	224	1587	1778	72	209
2.	Ghindwara	164	927	6469	8168	255	737
3	Baganikhal	105	653	4705	5207	187	563
4.	Diusi	67	371	2528	3093	100	307
5.	Ghandiyal	75	444	3103	3680	126	365
6.	Kanskhet	71	409	2772	3422	113	331
7.	Nahsain	86	500	3473	4401	138	392
8.	Safdarkhal	75	450	3163	3672	128	375
9.	Kamalpur	33	214	1502	1761	61	180
10.	Jamlakhal	92	427	2742	3832	106	342
11.	Delchaunri	86	495	3451	4198	137	405
12.	Khandiunsain	70	400	2809	3593	110	311
13.	Kot	86	449	3180	4288	124	335
14.	Kholchaunri	50	302	2098	2446	85	253
15.	Lwali	56	333	2357	2896	94	265
16.	Adhwani	23	149	1081	1155	45	129
17.	Kaljikhal	66	389	2722	3181	109	325
18.	Saknikhet	51	279	1917	2413	76	225
19.	Banghat	71	407	2826	3484	112	328
20.	Satpuli	82	467	3316	3701	133	401
21.	Kandarpani	102	564	3795	4388	153	491
22.	Mawadhar	36	201	5698	1598	61	172
23.	Patisain	24	156	1091	1082	46	143
24.	Mundneshwar	83	487	3339	3787	136	419

APPENDIX VI 5 : (*Contd*)

1	2	3	4	5	6	7	8
25	Pipalpani	35	239	1746	4506	72	225
26	Jakheti	50	318	2272	2365	92	282
2[illegible]	\grora	99	407	2239	3761	84	317
28.	Paidul	51	277	1868	2438	74	220
29.	Parsundakhal	88	514	3242	4507	140	398
30.	Bubakhal	42	226	1565	1983	62	181
31.	Kandara	40	233	1617	1878	64	201
32.	Daduadevi	42	218	2282	1851	56	184
33.	Pauri	101	569	3885	4937	56	452
34.	Kyark	101	532	3562	4900	140	405
35.	Kirtinagar	32	189	1329	1514	52	162
36.	Srinagar	62	322	2077	3056	82	234
37.	Sumari	138	577	5369	6436	223	661
38.	Chaubatiakhal	47	249	1545	2067	58	189
39.	Choprium	35	170	1077	1395	44	146
40.	Bhainswara	32	159	761	864	41	115
41.	Sikukhal	30	206	1740	2086	63	189
42.	Pokhrikhet	52	488	2825	3831	163	440
43.	Champeshwar	52	309	2112	2527	84	263
44.	Pabau	65	372	2558	3234	100	304
45.	Khirsu	120	704	4733	6035	190	566
46.	Kherakhal	99	450	2953	4173	115	340
47.	Bhattisera	88	575	4063	4862	164	465
48.	Mailisain	57	301	2099	2479	81	264
49.	Chifalghat	49	264	1720	2369	67	194
50.	Sankarsain	48	262	1645	1901	73	202

APPENDIX VI 5 : (*Contd*)

1	2	3	4	5	6	7	8
51.	Cholusain	37	214	1511	1749	60	182
52.	Bajwar	19	111	780	739	31	96
53.	Damdeval	42	217	1472	1893	57	180
54	Chaunrikhal	19	111	773	834	31	98
55	Pohkri	17	94	652	809	25	78
56.	Bhira	37	214	1492	1727	59	181
57	Thailisain	112	682	2982	4386	185	396
58.	Nautha	50	266	2058	2415	80	240
59	Chakisain	59	305	2197	2781	88	263
60.	Paithani	57	326	2380	2690	92	279
61.	Barsuri	64	275	4021	3142	109	327
62.	Rudraprayag	96	400	3858	4418	158	480
63.	Khankara	25	148	1036	1276	31	97
64.	Sumerpur	16	94	879	815	31	104
65.	Ratura	55	278	1874	2470	72	227
66.	Molkakhal	47	299	1943	2056	81	275
67.	Gidokhal	11	75	538	549	23	69
68.	Chaunra	61	377	2728	3174	98	331
69.	Gadoli	52	225	1425	2267	53	174
70.	Tarpali	25	205	952	1256	37	107
71.	Bungidhar	167	975	6246	7953	247	795
72.	Samoya	103	594	3876	4644	160	506
	Total	**4517**	**25312**	**180281**	**217222**	**7055**	**21087**

APPENDIX VI 6 · PAURI TEHSIL · ESTIMATED REQUIREMENT OF PESTICIDES—1984

S. No	Name of Cluster	Parathion (in litres)	Endrine (in litres)	D.D.T. (in Kg)	B.H.C. (in Kg.)	Aldrin (in litres)	Nicotine (in litres)
1	2	3	4	5	6	7	8
1	B.hbazar	70	331	2620	3905	74	215
2.	Ghindwara	156	1136	8326	9521	331	945
3.	Baganikhal	124	676	6190	7518	239	537
4.	Diusi	63	473	3406	3631	138	411
5.	Ghandiyal	118	742	5079	6758	199	575
6.	Kanskhet	77	583	4159	4811	173	515
7.	Nahsain	89	665	5006	5467	198	563
8.	Safdarkhal	71	567	4163	4538	168	484
9.	Kamalpur	67	456	3330	3973	130	373
10.	Jamlakhal	80	671	4565	5307	189	558
11.	Delchaunri	119	624	4140	6421	153	462
12.	Khandiunsain	69	426	2882	3904	115	320
13.	Kot	81	458	2980	4411	119	320
14.	Kholchaunri	71	455	3182	4119	125	361
15.	Lwali	81	525	3640	4657	150	420
16.	Adhwani	32	230	1707	1943	67	194
17.	Kaljikhal	62	425	2992	3717	119	344
18.	Saknikhet	56	488	3566	3689	149	411
19.	Banghat	91	663	4750	5563	190	544
20.	Satpuli	65	530	4201	4294	158	500
21.	Kandarpani	81	672	4722	5445	187	590
22.	Mawadhar	29	248	1702	1952	69	212
23.	Patisain	17	187	1306	1220	53	169
24.	Mundneshwar	71	551	3965	4624	156	477

APPENDIX VI 6 : (*Contd*)

1	2	3	4	5	6	7	8
25	Pipalpani	19	165	1209	1340	45	157
26.	Jakheti	35	366	2698	2609	112	333
27	Agrora	61	453	2566	4032	104	356
28.	Paidul	53	372	2715	3183	106	308
29	Parsundakhal	80	582	4195	3870	168	478
30	Bubakhal	43	304	2217	2597	88	251
31	Kandara	28	233	1618	1875	64	199
32	Daduadevi	36	285	2030	2336	81	242
33	Pauri	101	637	4178	5793	174	502
34.	Kyark	80	589	4268	4932	169	491
35.	Kirtinagar	54	365	2485	3199	100	286
36.	Srinagar	100	604	3967	5600	168	481
37.	Sumari	164	842	6989	7803	277	602
38.	Chaubatiakhal	34	280	2024	2212	81	240
39.	Choprium	19	182	1179	1420	47	163
40.	Bhainswara	14	101	762	858	29	86
41.	Sikukhal	32	263	1898	2088	76	222
42.	Pokhrikhet	55	580	4193	4149	173	523
43.	Champeshwar	56	409	2911	3517	114	347
44.	Pabau	64	427	2973	3823	116	344
45.	Khirsu	121	814	5432	7209	219	634
46.	Kherakhal	106	617	4259	5912	161	475
47.	Bhattisera	125	818	5725	7270	228	643
48.	Mailisain	77	502	3489	4553	133	411
49.	Chifalghat	72	455	3187	4125	125	352
50.	Sankarsain	55	448	3116	3577	128	371

APPENDIX VI.6 : (*Contd.*)

1	2	3	4	5	6	7	8
51.	Cholusain	32	253	1793	2052	73	213
52.	Bajwar	14	108	830	879	31	93
53.	Damdeval	35	328	2277	2696	93	284
54.	Chaunrikhal	11	113	781	833	32	100
55.	Pokhri	13	94	687	809	26	80
56.	Bhira	26	212	1603	1711	59	179
57.	Thailisain	79	860	5388	5991	233	735
58	Nautha	52	410	2879	3317	118	338
59	Chakisain	71	477	3268	4222	130	379
60.	Paithani	43	321	2359	2608	95	266
61.	Barsuri	74	517	3583	4485	142	417
62	Rudraprayag	94	731	5034	7213	205	599
63.	Khankara	39	236	1658	2196	64	187
64	Sumerpur	10	98	906	722	32	108
65.	Ratura	69	422	2635	3964	106	309
66	Molkakhal	26	321	2141	2249	91	293
67	Gidokhal	14	103	846	780	34	86
68	Chaunia	80	575	4606	4586	185	477
69.	Gadoli	51	406	2749	3318	112	338
70.	Tarpali	25	124	927	1223	37	83
71.	Bungidhar	133	1118	8571	8388	354	952
72.	Samoya	80	686	5227	5032	·220	576
	Total	**4585**	**32988**	**235610**	**281545**	**9407**	**27893**

APPENDIX IX.1 : PAURI TEHSIL : PROPOSED RICE MILLS AND THEIR SERVICE AREAS

S. No.	Clusters to be served	1979		1984	
		Quantity of paddy to be processed (in tonnes)	Location of Rice Mills	Quantity of paddy to be processed (in tonnes)	Location of additional rice mills
1	2	3	4	5	6
1.	Ghandiyal Baganikhal Diusi Kanskhet Nahsain Adhwani Saknikhet	924	Ghandiyal	1975	Kanskhet
2.	Safdarkhal Bahbazar Ghindwara Kamalpur Kholchaunri	738	Safdarkhal	1588	Bahbazar
3.	Kot Jamlakhal Khandiunsain	698	Kot	950	—
4.	Satpuli Banghat Kandarpani Mawadhar Patisain Mundneshwar	617	Satpuli	1104	
5.	Parsundakhal Kaljkhal Pipalpani Jakheti Agrora Paidul Pandara Sikukhal Pokhrikhet	868	Parsundakhal	1410	Pokhrikhet
6.	Pauri Lwali Bubakhal Daduadevi Chaubatiakhal Choprium Bhainswara	615	Pauri	1093	—

APPENDIX IX.1 : (*Contd.*)

1	2	3	4	5	6
7.	Srinagar Delchaunri Kyark Kirtinagar	581	Srinagar	1214	Kirtinagar
8.	Khirsu Sumari Bhattisera	629	Khirsu	1277	Khirsu
9.	Bhira Champeshwar Pabau Cholusain Bajwar Damdeval Chaunrikhal Pokhri Nautha	635	Bhira	1180	—
10.	Thailisain Tarpali Bungidhar Samoya	605	Thailisain	1151	—
11.	Chakisain Mailisain Chifalghat Sankarsain Paithani Molkakhal Gidokhal Chaunra Gadoli	770	Chakisain	1745	Chifalghat
12.	Rudraprayag Kherakhal Barsuri Khankara Sumerpur Ratura	694	Rudraprayag	1457	Kherakhal

APPENDIX IX 2 : PAURI TEHSIL—PROPOSED FLOUR MILLS AND THEIR SERVICE AREAS-1979 AND 1984

S. No.	Location of the flour mill	1974—1979		1979—1984	
		Clusters to be served	Quantity of wheat and mandua to be processed	Clusters to be served	Quantity of wheat and mandua to be processed
1	2	3	4	5	6
1.	Bahbazar	Bahbazar	196	Bahbazar	207
2.	Ghindwara	Ghindwara	511	Gindwara	532
3	Baganikhal	Baganikhal	350	Baganikhal	384
4	Diusi	—	—	Diusi	210
5.	Ghandiyal	Ghandiyal, Diusi, Saknikhet	709	Ghandiyal, Saknikhet	756
6.	Kanskhet	Kanskhet	378	Kanskhet	380
7.	Nahsain	Nahsain	459	Nahsain	492
8.	Safdarkhal	Safdarkhal	454	Safdarkhal	485
9.	Kamalpur	Kamalpur	322	Kamalpur	342
10.	Jamlakhal	Jamlakhal	388	Jamlakhal	411
11.	Delchaunri	Delchaunri	575	Delchaunri	614
12.	Khandiunsain	Khandiunsain	399	Khandiunsain	405
13.	Kot	Kot	494	Kot	527
14.	Kholchaunri	Kholchaunri	324	Kholchaunri	346
15.	Lwali	Lwali, Daduadevi	542	Lwali, Daduadevi	578
16.	Kaljikhal	Kaljikhal, Adhwani	494	Kaljikhal, Adhwani	537
17.	Banghat	Banghat	305	Banghat	324
18.	Satpuli	Satpuli	213	Satpuli	228
19.	Kandarpani	Kandarpani	366	Kandarpani	392

APPENDIX IX.2 : (*Contd.*)

1	2	3	4	5	6
20.	Mawadhar	Patisain, Mawadhar	297	Mawadhar, Patisain	317
21.	Mundneshwar	Mundneshwar	352	Mundneshwar	375
22.	Pipalpani	Pipalpani	297	Pipalpani	300
23.	Jakheti	Jakheti	311	Jakheti	331
24.	Agrora	—	—	Agrora	278
25.	Paidul	Paidul, Agrora	541	Paidul	290
26.	Parsundakhal	Parsundakhal	509	Parsundakhal	543
27.	Kandara	Kandara, Bubakhal	485	Kandara, Bubakhal	516
28.	Pauri	Pauri	1942	Pauri	2070
29.	Kyark	Kyark	387	Kyark	389
30.	Srinagar	Srinagar	1162	Srinagar	1236
31.	Sumari	Sumari	584	Sumari	711
32.	Chaubatiakhal	Chaubatiakhal	338	Chaubatiakhal	352
33.	Bhainswara	Bhainswara, Choprium	486	Bhainswara, Choprium	516
34.	Sikukhal	Sikukhal	349	Sikukhal	372
35.	Pokhrikhet	Pokhrikhet	464	Pokhrikhet	494
36.	Champeshwar	Champeshwar	412	Champeshwar	439
37.	Pabau	Pabau	483	Pabau	512
38.	Khirsu	Khirsu	698	Khirsu	738
39.	Bhattisera	Bhattisera, Khaukara	496	Bhattisera, Khankara	530
40.	Kherakhal	Kherakhal	718	Kherakhal	766
41.	Chifalghat	Chifalghat, Sankarsain	561	Chifalghat	307
42.	Mailisain	Mailisain	271	Mailisain	289
43.	Sankarsain	—	—	Sankarsain	281

APPENDIX IX.2 : (*Contd.*)

1	2	3	4	5	6
44.	Cholusain	Cholusain, Bajwar	375	Cholusain, Bajwar	398
45.	Damdeval	Damdeval, Chaunrikhal	337	Damdeval, Chaunrikhal	359
46	Bhira	Bhira, Pokhri	333	Bhira, Pokhri	354
47.	Thailisain	Thailisain	654	Thailisain	698
48.	Nautha	Nautha	386	Nautha	389
49.	Chakisain	Chakisain	352	Chakisain	374
50.	Paithani	Paithani	411	Paithani	438
51.	Barsuri	Barsuri	555	Barsuri	591
52.	Rudraprayag	Rudraprayag	589	Rudraprayag	627
53.	Ratura	Ratura, Sumerpur	416	Ratura, Sumerpur	443
54.	Molkakhal	Molkakhal, Gidokhal	353	Gidokhal, Molkakhal	376
55.	Chaunra	Chaunra	534	Chaunra	568
56.	Tarpali	Tarpali, Gadoli	504	Tarpali, Gadoli	535
57.	Bungidhar	Bungidhar	752	Bungidhar	802
58.	Samoya	Samoya	252	Samoya	268

APPENDIX X I

A Methodological Note on Population Projections—Pauri Tehsil

A simple and direct method was used in projecting the populations of different clusters in Pauri Tehsil. Any change in the size of population in any region is determined by the corresponding changes in the three components of population namely, births, deaths and migration. This may be expressed as :

$$Pt = Po + B + I - O - D$$

where

Pt	=	Population at time 't'
Po	=	Population in the base period
B	=	No of births
D	=	No. of deaths
I	=	No of Immigrants
O	=	No. of out-migrants

Similarly to obtain the growth rate 'r'

r = Birth rate—Death rate + (In-migration rate—Out migration rate)

= Birth rate—Death rate + Net-migration rate.

No data on births and deaths were available either for Pauri Tehsil or for Garhwal district as a whole. Therefore the birth rate 46.05 and the death rate 23 21 per thousand population obtained from the sample registration data for the state of Uttar Pradesh for the year 1970, were assumed to hold good for Pauri Tehsil also.

Estimation of Net-migration Rate

In estimating the net-migration rate, the age-distributions by sex of 1961 and1971 censuses of Garhwal district were used for calculating the same for Pauri Tehsil. The age distribution by sex of 1961 population of the Tehsil was brought forward to 1971 after applying survival rates for males and females in order to obtain in the estimated age-sex distribution in 1971 resulting only from natural growth. The respective survival rates for males and females were obtained from the West Model Life Tables for the expectation of lifes at birth : 47.4 years for males and 46.1 years for females, for the year 1966. The expected population thus obtained was subtracted from the enumerated population of 1971 for Garhwal district The balance was assumed to be the net-migrants in the tehsil between 1961 and 1971. Using the figure for net-migrants, the net-migration rate was computed. Thus turned out to be—11.30 persons per thousand population per year. This estimate was subjected to a validation test by checking it against data on known out-migration.

It is known that in Garhwal district, a large number of people is recruited to the army every year. The Garhwal Regiment, for example, consists mainly of recruits from this district. The data on army retirements every year and the age of retirement were available for the Tehsil. Using this data, the rate of out-migraton, due exclusively to joining the army, was estimated to be around 10 persons per thousand population per year. Giving allowance for persons migrating for reasons other than joining the army such as employment opportunities, the estimated net-migration rate (–11.30) therefore, seems quite reasonable. It may also be noted that the volume of in-migrants in the Tehsil, by all accounts, is practically negligible.

The actual computation of the rate of growth of population in the Tehsil was thus done with th help of the formula mentioned earlier.

Growth rate (r) = 46.05—23.21—11.30 = 11.52 per thousand population per year.

or

1 152 per cent per year.

Using the 1971 population as base, the population projections for different clusters were obtained by using the formula.

$$Pt = Po.\ e^{0\ 01152t}$$

where Pt = Population at time 't'

Po = Population in the base period

t = Time period

e = Exponential Growth

References : A.J Coale and P. Demeny, *Regional Model Life Tables and Stable Populations*, Princeton, University Press, New Jersey, 1966.

APPENDIX X.2 : PAURI TEHSIL : ESTIMATED SCHOOL-GOING POPULATION AND ENROLMENT, 1973

S. No.	Name of Cluster	Population 1973	Estimated school-going population in different age-groups				Enrolment of children in different classes			
			6—10	11—13	14—15	16—17	I—V	VI—VIII	IX—X	XI—XII
1	2	3	4	5	6	7	8	9	10	11
1.	Bahbazar	1531	259	110	56	46	234	59	21	5
2.	Ghindwara	3920	662	282	145	118	598	150	54	14
3.	Baganikhal	2818	476	203	104	85	430	108	39	10
4.	Diusi	1570	265	113	58	47	239	60	22	6
5.	Ghandiyal	2580	435	186	96	78	394	99	36	9
6.	Kanskhet	2964	500	213	109	89	451	114	41	11
7.	Nahsain	3522	596	254	130	106	538	135	49	13
8.	Safdarkhal	3531	597	254	130	106	538	135	49	13
9.	Kamalpur	2552	430	184	95	77	390	98	35	9
10.	Jamlakhal	3095	522	223	114	94	473	119	43	11
11.	Delchaunri	4494	759	324	166	136	686	173	62	16
12.	Kandiunsain	2874	485	207	106	87	433	1'0	40	10
13.	Kot	3738	631	269	139	112	570	143	52	13
14.	Kholchaunri	2551	430	184	95	77	390	98	35	9
15.	Lwali	2565	433	185	96	77	392	99	36	9

APPENDIX X 2 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11
16.	Adhwani	1280	216	92	47	39	195	49	18	5
17.	Kaljikhal	2740	462	197	101	83	419	105	38	10
18.	Saknikhet	1389	235	100	51	42	212	53	19	5
19.	Banghat	2355	400	169	85	70	360	90	32	8
20.	Satpuli	1692	285	122	63	51	258	65	24	6
21.	Kandarpani	3082	520	222	114	93	471	118	43	11
22.	Mawadhar	1144	193	82	42	35	175	44	16	4
23.	Patisain	1251	211	90	46	38	191	48	17	5
24.	Mundneshwar	2880	486	207	106	87	439	110	40	10
25.	Pipalpani	2213	374	159	81	67	338	85	30	8
26.	Jakheti	2453	414	177	91	74	375	94	34	9
27.	Agrora	2110	356	152	78	64	322	81	29	8
28.	Paidul	2120	358	153	79	64	225	82	30	8
29.	Parsundakhal	4134	698	298	153	125	632	159	57	15
30.	Kandara	2557	431	184	95	77	390	98	35	9
31.	Bubakhal	1260	212	91	47	38	173	49	18	5
32.	Daduadevi	1589	269	114	58	48	243	61	22	6
33.	Pauri	15050	2542	1083	555	454	2295	577	207	54

34.	Kyark	3019	510	217	111	91	460	116	41	11
35.	Kirtinagar	1426	241	103	53	43	218	55	20	5
36.	Srinagar	7578	1279	546	280	229	1156	291	105	27
37.	Sumari	4640	784	334	171	140	708	178	64	17
38.	Chaubatiakhal	2644	447	190	97	80	404	102	36	9
39.	Choprium	2209	373	159	81	67	337	85	30	8
40.	Bhainswara	1593	269	115	59	48	243	61	22	6
41.	Sikukhal	2712	458	195	100	82	413	105	37	10
42.	Pokhrikhet	3683	622	265	136	111	562	141	51	13
43.	Champeshwar	3316	560	239	123	100	506	127	46	12
44.	Pabau	3848	650	277	142	116	587	148	53	14
45.	Khirsu	5487	727	395	202	166	837	211	75	20
46.	Bhattisera	2776	469	200	102	84	423	107	38	10
47.	Kherakhal	5645	952	406	208	171	861	216	78	20
48.	Mailisain	2235	377	161	83	67	340	86	31	8
49.	Chifalghat	2300	388	166	85	70	351	89	32	8
50.	Sankarsain	2090	353	150	77	63	319	80	29	7
51.	Cholusain	1856	313	134	69	56	283	71	26	7
52.	Bajwar	1128	190	81	42	34	172	43	16	4
53.	Damdeval	2116	357	152	78	64	323	81	29	8

Appendix X.2 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11
54.	Chaunrikhal	617	104	44	23	18	94	23	9	2
55.	Pokhri	1140	192	82	42	35	175	44	16	4
56.	Bhira	1491	252	107	55	45	228	57	21	5
57.	Thalisain	5398	911	388	199	163	824	207	74	19
58.	Nautha	2850	481	205	105	86	434	109	39	10
59.	Chakisain	2785	471	201	103	84	425	108	38	10
60.	Paithani	3272	552	236	121	99	499	126	45	12
61.	Barsuri	4396	742	317	163	133	672	169	61	16
62.	Rudraprayag	4682	791	337	173	141	714	180	65	17
63	Khankara	1157	196	83	42	35	177	44	16	4
64.	Sumerpur	715	120	51	26	22	109	27	10	3
65.	Ratura	2661	449	192	98	81	405	102	37	10
66.	Molkakhal	2424	410	175	90	73	370	93	34	9
67.	Gidokhal	618	104	44	23	18	94	23	9	2
68.	Chaunra	4294	725	309	158	130	656	165	59	15
69	Gadoli	2834	479	204	105	85	433	109	39	10
70.	Tarpali	1119	188	81	42	34	170	43	16	4
71.	Bungidhar	6145	1031	442	227	185	938	236	85	22
72.	Samoya	2074	350	149	76	63	316	79	28	7
	Total	**288577**	**35225**	**15015**	**7701**	**6296**	**31710**	**8005**	**2883**	**749**

APPENDIX X.3 : PAURI TEHSIL : ESTIMATED SCHOOL-GOING POPULATION AND ENROLMENT—1979

S. No.	Name of Cluster	Population 1979	Estimated school-going population in different age-groups				Enrolment of children in different classes			
			6—10	11—13	14—15	16—17	I—V	VI—VIII	IX—X	XI—XII
1	2	3	4	5	6	7	8	9	10	11
1.	Bahbazar	1651	279	119	61	50	265	66	26	19
2.	Ghindwara	4229	715	304	156	127	679	167	63	21
3.	Baganikhal	3041	514	219	112	92	488	120	46	16
4.	Diusi	1690	285	122	63	51	271	68	26	9
5.	Ghandiyal	2784	471	200	102	84	447	110	42	15
6.	Kanskhet	3198	539	230	118	97	512	126	48	16
7.	Nahsain	3799	641	270	139	113	609	151	57	19
8.	Safdarkhal	3809	643	274	141	115	611	151	58	20
9.	Kamalpur	2753	465	198	101	83	442	109	42	15
10.	Jamlakhal	3338	563	240	123	101	535	132	50	17
11.	Delchaunri	4849	819	349	179	146	778	192	72	24
12.	Khandiunsain	3100	523	223	114	94	497	123	46	16
13.	Kot	4032	270	149	121	647	160	160	60	20
14.	Kholchaunri	2751	465	198	101	83	442	109	42	15
15.	Lwali	2768	468	199	101	84	445	111	42	15

APPENDIX X.3 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11
16.	Adhwani	1271	214	92	47	39	203	56	22	8
17.	Kaljikhal	2956	499	213	109	90	474	117	45	16
18.	Saknikhet	1498	253	108	56	45	240	60	23	8
19.	Banghat	2534	428	182	94	76	407	102	39	14
20.	Satpuli	1826	308	131	67	55	293	72	28	10
21.	Kandarpani	3320	560	239	68	55	532	132	49	17
22.	Mawadhar	1234	208	89	46	37	198	50	18	7
23.	Patisain	1350	227	97	50	41	216	54	21	8
24.	Mundneshwar	3107	525	224	115	94	499	123	46	15
25.	Pipalpani	2387	403	172	88	72	383	96	37	13
26.	Jakheti	2646	447	191	98	80	425	105	40	14
27.	Agrora	2276	384	164	84	69	365	91	35	12
28.	Paidul	2288	386	165	85	69	367	92	35	12
29.	Parsundakhal	4460	753	321	164	135	715	177	66	22
30.	Kandara	2757	464	199	102	83	441	109	42	15
31.	Bubakhal	1358	229	98	51	41	218	55	21	8
32.	Daduadevi	1714	289	239	63	52	275	69	26	9
33.	Pauri	16240	2743	1169	599	490	2606	644	242	82

34. Kyark	3257	550	235	120	99	523	129	48	16
35. Kirtinagar	1538	260	111	57	47	247	62	24	9
36. Srinagar	8175	1381	589	302	247	1312	323	121	41
37. Sumari	5018	847	361	185	152	805	198	74	25
38. Chaubatiakhal	2853	482	205	105	86	458	113	43	15
39. Choprium	2383	403	172	88	72	383	95	36	13
40. Bhainswara	1719	290	124	64	52	276	77	27	10
41. Sikukhal	3000	507	216	111	90	482	116	44	15
42. Pokhrikhet	3973	672	286	146	120	638	157	60	21
43. Champeshwar	3577	604	258	133	108	574	142	54	19
44. Pābau	4151	701	299	153	126	666	164	62	22
45. Khirsu	5905	997	425	218	178	947	234	88	30
46. Bhattisera	2995	506	216	111	90	481	118	44	16
47. Kherakhal	6089	1029	438	224	184	978	241	90	30
48. Mailisain	2410	407	174	89	73	387	96	37	13
49. Chifalghat	2481	419	179	92	75	398	99	38	13
50. Sankarsain	2255	378	162	83	68	359	90	34	12
51. Cholusain	1956	327	141	73	59	311	80	31	11
52. Bajwar	1217	206	88	45	37	196	49	19	7
53. Damdeval	2283	382	164	84	69	363	91	35	12

APPENDIX X 3 : (Contd.)

1	2	3	4	5	6	7	8	9	10	11
54.	Chaunrikhal	665	112	48	25	20	106	27	11	4
55.	Pokhri	1230	208	89	46	37	198	50	19	7
56.	Bhira	1609	272	116	59	49	258	65	25	9
57.	Thailisain	5822	984	419	215	175	935	230	86	29
58.	Nautha	3075	519	221	113	93	493	122	46	16
59.	Chakisain	3004	508	216	111	90	483	119	46	16
60.	Paithani	3530	596	254	129	105	566	139	53	19
61.	Barsuri	4742	801	341	175	143	761	188	70	24
62.	Rudraprayag	5052	854	364	187	153	811	200	75	24
63	Khànkara	1248	211	90	46	38	200	51	20	7
64.	Sumerpur	778	131	56	29	24	124	32	12	5
65.	Ratura	2870	485	207	106	87	461	113	44	15
66.	Molkakhal	2615	273	116	59	49	259	104	40	14
67.	Gidokhal	666	112	48	25	20	106	27	11	4
68.	Chaunra	4633	783	334	171	140	744	183	69	23
69.	Gadoli	3058	517	270	113	92	491	121	46	16
70.	Tarpali	1207	204	87	45	36	194	49	19	7
71.	Bungidhar	6628	1119	473	245	200	1063	262	98	33
72.	Samoya	2238	378	161	83	67	359	89	34	12
	Total	**223919**	**37806**	**16119**	**8211**	**6714**	**35921**	**8964**	**3398**	**1171**

APPENDIX 4 : PAURI TEHSIL : ESTIMATED SCHOOL-GOING POPULATION AND ENROLMENT—1984

S. No.	Name of Cluster	Population 1984	Estimated School-going population in different age-groups				Enrolment of children in different classes			
			6—10	11—13	14—15	16—17	I—V	VI—VIII	IX—X	XI—XII
1	2	3	4	5	6	7	8	9	10	11
1.	Bahbazar	1758	296	127	64	54	296	38	32	12
2.	Ghindwara	4504	761	324	166	136	761	214	83	29
3.	Baganikhal	3239	547	233	119	98	547	154	59	21
4.	Diusi	1805	305	130	67	54	305	85	34	14
5.	Ghandiyal	2965	500	213	109	90	500	141	54	19
6.	Kanskhet	3406	576	245	125	103	575	161	61	22
7.	Nahsain	4047	684	291	149	122	684	192	3	726
8.	Safdarkhal	4057	685	292	150	122	685	192	73	26
9.	Kamalpur	2932	495	211	108	89	495	131	53	19
10.	Jamlakhal	3555	600	256	131	108	600	169	64	23
11.	Delchaunri	5164	871	372	191	156	871	245	93	34
12.	Khandiunsain	3302	558	238	122	100	558	157	60	22
13.	Kot	4294	725	309	158	130	725	204	78	28
14.	Kholchaunri	2930	495	211	108	89	495	139	53	19
15.	Lwali	2947	497	212	109	89	497	140	54	19

APPENDIX X.4 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11
16.	Adhwani	1353	228	97	50	41	228	54	24	10
17.	Kaljikhal	3149	531	227	117	95	531	149	57	20
18.	Saknikhet	1595	270	115	59	48	270	76	89	11
19.	Banghat	2700	456	194	100	81	456	128	49	18
20.	Satpuli	1945	328	140	72	59	328	92	35	13
21.	Kandarpani	3542	598	255	131	107	598	168	64	23
22.	Mawadhar	1314	221	95	49	40	221	62	24	9
23.	Patisain	1437	243	103	53	43	243	68	26	9
24.	Mundneshwar	3309	559	238	122	100	559	157	60	22
25.	Pipalpani	2546	430	183	94	77	430	121	46	17
26.	Jakheti	2819	476	203	104	85	476	134	51	18
27.	Agrora	2424	410	175	90	73	410	115	44	16
28.	Paidul	2436	412	175	90	73	412	115	44	16
29.	Parsundakhal	4750	803	342	175	144	803	225	86	31
30.	Bubakhal	2937	494	212	109	89	494	139	53	19
31.	Kandara	1446	244	103	53	44	244	69	26	10
32.	Daduadevi	1826	308	131	68	54	306	87	33	12
33.	Pauri	17300	2925	1246	639	522	2925	821	133	113

34.	Kyark	3467	586	245	125	103	586	165	63	23
35.	Kirtinagai	1634	277	118	61	149	277	78	30	11
36.	Srinagar	8708	1470	627	322	263	1470	413	157	57
37.	Sumari	5344	902	385	197	162	902	254	97	35
38.	Chaubatiakhal	3039	513	219	112	92	513	144	55	20
39.	Choprium	2538	428	183	94	77	428	121	46	17
40.	Bainswara	1831	309	132	68	54	309	87	33	13
41.	Sikukhal	3196	539	230	118	97	539	152	58	20
42.	Pokhrikhet	4232	715	305	156	128	715	201	77	27
43.	Champeshwar	3810	643	274	141	115	643	181	69	25
44	Pabau	4421	746	318	163	134	764	210	80	29
45.	Khirsu	6290	1063	453	238	194	1063	298	114	41
46.	Kherakhal	3190	538	230	118	97	538	152	58	21
47.	Bhattisera	6486	1096	467	239	196	1096	308	117	42
48.	Mailisain	2566	433	185	95	78	433	122	46	17
49.	Chifalghat	2643	446	190	97	80	446	124	48	17
50.	Sankarsain	2402	406	173	89	72	406	113	43	16
51.	Cholusain	2084	352	150	77	63	352	98	37	14
52.	Bajwar	1296	219	93	48	39	219	62	24	9
53.	Damdeval	2432	411	175	95	78	411	114	44	16

Appendix X. 4 : (Contd)

1	2	3	4	5	6	7	8	9	10	11
54.	Chaunrikhal	708	119	51	26	22	119	33	13	5
55.	Pokhri	1370	221	94	48	40	221	52	24	9
56.	Bhira	1714	289	123	63	52	289	81	31	11
57.	Thailisain	6201	2047	446	229	187	1047	295	112	40
58.	Nautha	3275	553	236	121	99	553	155	59	21
59.	Chakisain	3200	538	230	118	97	538	152	58	20
60.	Paithani	3759	634	270	139	113	604	178	68	24
61.	Barsuri	5052	853	364	187	153	853	240	91	33
62.	Rudraprayag	5380	908	387	199	162	908	255	97	35
63.	Khankara	1329	224	96	50	40	224	63	24	9
64.	Sumerpur	821	139	59	30	25	139	39	15	6
65.	Ratura	3057	716	220	113	92	516	145	55	20
66.	Molkakhal	2786	471	201	108	89	471	113	31	18
67.	Gidokhal	708	119	51	26	22	119	33	13	5
68.	Chaunra	4934	833	355	182	149	833	234	89	32
69.	Gadoli	3257	549	235	121	99	549	155	59	21
70.	Tarpali	1285	217	93	48	39	217	61	23	9
71.	Bungidhar	7066	1198	509	261	213	1194	335	192	46
72.	Samoya	2383	403	172	88	72	403	113	43	16
	Total	**239573**	**40450**	**17243**	**8862**	**7251**	**40450**	**11344**	**4379**	**1570**

APPENDIX X 5 : PAURI TEHSIL—EXISTING AND PROPOSED PRIMARY SCHOOLS

S. No.	Name of the Cluster	No. of schools existing in 1973	1974—79: No. of new schools	1974—79: Location of new school: Name of settlement	1974—79: Location of new school: Census Code No.	1979—84: No. of new schools	1979—84: Location of new school: Name of settlement	1979—84: Location of new school: Census Code No.	Total No. of schools by 1984
1	2	3	4	5	6	7	8	9	10
1.	Bahbazar	2	1	Khera Guinth	596	—	—	—	3
2.	Ghindwara	12	1	Kharkhola	603	—	—	—	13
3.	Baganikhal	5	1	Deosa	738	1	Bidang	725	7
4.	Diusi	6	—	—	—	—	—	—	6
5.	Ghandiyal	8	—	—	—	—	—	—	8
6.	Kanskhet	6	—	—	—	1	Asgad	844	7
7.	Nahsain	3	2	Manjkot & Palka	705,709	1	Mahlon	623	6
8.	Safdarkhal	6	1	Nakhun	622	—	—	—	7
9.	Kamalpur	8	—	—	—	—	—	—	8
10.	Jamlakhal	9	1	Kanda	544	—	—	—	10
11.	Delchaunri	6	—	—	—	—	—	—	6
12.	Khandiunsain	5	2	Rawatkafatha, Dewar	464,640	—	—	—	7
13.	Kot	5	2	Kanda, Khola	646,654	—	—	—	7

APPENDIX X.5 : *(Contd.)*

1	2	3	4	5	6	7	8	9	10
14.	Kholchaunri	5	—	—	—	—	—	—	5
15.	Lwali	4	1	Gumain	356	—	—	—	5
16.	Adhwani	4	—	—	—	—	—	—	4
17.	Kaljikhal	5	—	—	—	—	—	—	5
18.	Saknikhet	4	—	—	—	—	—	—	4
19.	Banghat	9	—	—	—	—	—	—	9
20	Satpuli	4	—	—	—	—	—	—	4
21.	Kandarpani	5	—	—	—	1	Suralgaon	954	6
22.	Mawadhar	2	1	Jhatkandi	917	—	—	—	3
23.	Patisain	3	—	—	—	—	—	—	3
24.	Mandneshwar	7	—	—	—	—	—	—	7
25	Pipalpani	3	—	—	—	1	Toli	961	4
26.	Jakheti	6	1	Ghiri	978	—	—	—	7
27.	Agrora	4	—	—	—	—	—	—	4
28.	Paidul	1	2	Molthi, Sirali	324,342	—	—	—	3
29.	Parsundakhal	6	—	—	—	—	—	—	6
30.	Kandara	3	—	—	—	1	Tyothya L Kandara	310	4
31.	Bubakhal	2	—	—	—	—	—	—	2

32.	Daduadevi	2	—	—	—	1	Gagwara	378	3
33.	Pauri	15+4	—	—	—	2	Thali, Pauri	270 Pauri	21
34.	Kyark	7	—	—	—	—	—	—	7
35.	Kirtinagar	5	—	—	—	—	—	—	—
36.	Srinagar	4+3	2	Srinagar, Chairgaon	Srinagar 215	1	Khola	212	10
37.	Sumari	10	—	—	—	1	Bhelgarh	235	11
38.	Chaubatiakhal	5	2	Singori, Dhikwali	254,1108	1	Jhangabao	1059	8
39.	Choprium	4	—	—	—	—	—	—	4
40.	Bhainswara	2	1	Bhainswara	1043	—	—	—	3
41.	Sikukhal	5	—		—	—	—	—	5
42.	Pokhrikhet	4	1	Koli	1013	1	Chorkhandi	1021	6
43.	Champeshwar	6	—	—	—	1	Thapla	1044	7
44.	Pabau	8	—	—	—	1	Kolri	1098	9
45.	Khirsu	9	—	—	—	—	—	—	9
46.	Bhattisera	10	1	Suralgaon	174	—	—	—	11
47.	Kherakhal	15	—	—	—	—	—	—	15
48.	Mailisain	4	—	—	—	—	—	—	4
49.	Chifalghat	3	1	Bungh	1133	1	Ghuna	1117	5
50.	Sankarsain	4	—	—	—	1	Khankholi	1140	5
51.	Cholusain	6	—	—	—	1	Banekh	1155	7

APPENDIX X 5 : (Contd)

1	2	3	4	5	6	7	8	9	10
52.	Bajwar	2	—	—	—	—	—	—	2
53.	Damdeval	6	—	—	—	—	—	—	6
54.	Chaunrikhal	2	—	—	—	1	Harbiyana	1314	3
55.	Pokhri	2	—	—	—	1	Kalgun	1316	3
56.	Bhira	2	1	Bhandeli	1302	—	—	—	3
57.	Thailisain	11	2	Kainur, Jikholi	1299,1287	1	Rauli	1289	14
58.	Nautha	4	—	—	—	—	—	—	4
59.	Chakisain	4	—	—	—	1	Gweenthgaon	1272	5
60.	Paithani	9	—	—	—	—	—	—	9
61.	Barsuri	8	—	—	—	—	—	—	8
62.	Rudraprayag	7	—	—	—	—	—	—	7
63.	Khankara	3	1	Loli	33	—	—	—	4
64.	Sumerpur	2	—	—	—	—	—	—	2
65.	Ratura	6	—	—	—	—	—	—	6
66.	Molkakhal	5	—	—	—	—	—	—	5
67.	Gidokhal	1	—	—	—	—	—	—	1
68.	Chaunra	10	—	—	—	—	—	—	10
69.	Gadoli	4	2	Ghuleth, Rankhera	1242,1248	1	Kucholi	1239	7
70.	Tarpali	3	—	—	—	—	—	—	3
71.	Bungidhar	9	2	Dabra, Danchotimalli	1333,1364	2	Kimwari, Kandai	1337,1351	13
72.	Samoya	4	1	Bhairgaon	1390	—	—	—	5
	Total Schools	**397**	**33**			**25**			**455**

APPENDIX X.6 : PAURI TEHSIL—EXISTING AND PROPOSED JUNIOR HIGH SCHOOLS

(Non-Central Villages are identified by Census Code Numbers)

S. No	Namef of the Cluster	1973	1974—79		1979—84		Total by 1989
		No. of junior high schools	New construction.	Location (Census Code No.)	New construction	Location (Census Code No)	
1	2	3	4	5	6	7	8
1.	Bahbazar	—	—	—	—	—	—
2.	Ghindwara	1*	1	(716)	—	—	1
3.	Baganikhal	--	1	(730)	1	Central Village	2
4.	Diusi	1*	—	—	—	—	—
5.	Ghandiyal	—	1	(826)	1	Central Village	2
6.	Kanskhet	—	1	(748)	—	—	1
7.	Nahsain	—	1	(623)	—	—	1
8.	Safdarkhal	2*	—	—	—	—	1
9.	Kamalpur	1	—	—	1	(522)	2
10.	Jamlakhal	1*	—	—	—	—	—
11.	Delchaunri	1	1	(458)	1	(493)	3
12.	Khandiunsain	1**	1	Central Village	—	—	1
13.	Kot	1	—	—	1	Central Village	2

APPENDIX X.6 : (*Contd.*)

1	2	3	4	5	6	7	8
14.	Kholchaunri	—	—	—	—	—	—
15.	Lwali	1	—	—	—	—	1
16.	Adhwani	—	—	—	1	(634)	1
17.	Kaljikhal	1*	—	—	—	—	—
18.	Saknikhet	1*	—	—	—	—	—
19.	Banghat	1*	—	—	—	—	—
20.	Satpuli	—	—	—	1	(836)	1
21.	Kandarpani	—	1*	Central Village	1	(881)	1
22.	Mawadhar	—	—	—	—	—	—
23.	Patisain	1*	—	—	—	—	—
24.	Mundneshwar	1*	1	(876)	—	—	1
25.	Pipalpani	—	—	—	—	—	—
26.	Jakheti	—	—	—	—	—	—
27.	Agrora	—	1	Central Village	—	—	1
28.	Paidul	1*	—	—	—	—	—
29.	Parsundakhal	1*	1	(318)	—	—	1
30.	Kandara	—	1	Central Village	—	—	1
31.	Bubakhal	—	—	—	—	—	—

32	Daduadevi	1*	—	—	—	—	—
33.	Pauri	6**	1	Central Village	1	(267)	6
34.	Kyark	4*	—	—	—	—	3
35.	Kirtinagar	—	—	—	1	(420)	1
36.	Srinagar	1**	1	—	1	Central Village	2
37.	Sumari	2**	—	—	1	(159)	2
38.	Chaubatiakhal	—	1	(247)	1	Central Village	2
39.	Choprium	1*	—	—	1	(1087)	1
40.	Bhainswara	1	—	—	—	—	1
41.	Sikukhal	1	—	—	—	—	1
42.	Pokhrihhet	—	1	(1021)	—	—	1
43.	Champeshwar	1*	1	Central Village	1	(1048)	1
44.	Pabau	1	—	—	1	—	2
45.	Khirsu	1	1	(1107)	—	—	2
46.	Bhattisera	—	—	—	1	(183)	1
47.	Kherakhal	1*	—	—	2	—	2
48.	Mailisain	—	1	Central Village	—	—	1
49.	Chifalghat	—	1	Central Village	—	—	1
50.	Sankarsain	1**	—	—	—	—	—
51.	Cholusain	1	—	—	1	—	2

APPENDIX X.6 : (*Contd.*)

1	2	3	4	5	6	7	8
52.	Bajwar	—	—	—	1	Central Village	1
53.	Damdeval	—	1	—	—	—	1
54.	Chaunrikhal	1*	—	—	—	—	—
55.	Pokhri	1	—	—	—	—	1
56.	Bhira	1	—	—	—	—	1
57.	Thailisain	1	—	—	1	(1293)	2
58.	Nautha	1	1*	Central Village	—	—	1
59.	Chakisain	—	1	—	—	—	1
60.	Paithani	1*	—	—	1	(1190)	1
61.	Barsuri	2**	—	—	—	—	—
62.	Rudraprayag	1	1	(37)	—	—	2
63.	Khankara	—	1	Central Village	—	—	1
64.	Sumerpur	—	—	—	1	(8)	1
65.	Ratura	2*	—	—	—	—	1
66.	Molkakhal	1*	—	—	1	—	1
67.	Gidokhal	—	—	—	1	(1238)	1
68.	Chaunra	1	1	—	1	(1269)	3
69.	Gadoli	1*	—	—	1	(1240)	1
70.	Tarpali	1	—	—	—	—	—
71.	Bungidhar	1**	2	(1337)	2	—	4
72.	Samoya	—	1*	(1378)	1	Central Village	1
	Total	**56**	**28**		**31**		**82**

* To be upgraded as high school during 1974–79

** To be upgraded as high school during 1979–84

APPENDIX X.7 : PAURI TEHSIL : EXISTING AND PROPOSED HIGH SCHOOLS

S. No	Name of Cluster	1973		1974—79			1979—84			Total Schools by 1984
		No. of High Schools	Location	Upgrading from Junior High School	New Schools	Location	Upgrading from Junior High School	New Schools	Location	
1	2	3	4	5	6	7	8	9	10	11
1.	Bahbazar	—	—	—	—	—	—	—	—	—
2.	Ghindwara	—	—	1	—	Ghindwara	—	—	—	1
3.	Baganikhal	—	—	—	—	—	—	—	—	—
4.	Diusi	—	—	1	—	Diusi	—	—	—	1
5.	Ghandiyal	—	—	—	—	—	—	—	—	—
6.	Kanskhet	—	—	—	—	—	—	—	—	—
7.	Nahsain	1	Nahsain	—	—	—	—	—	—	1
8.	Safdarkhal	—	—	1	—	Safdarkhal	—	—	—	1
9.	Kamalpur	1*	Kamalpur	—	—	—	—	—	—	—
10.	Jamlakhal	—	—	1	—	Jamlakhal	—	—	—	1
11.	Delchaunri	1**	Delchaunri	—	—	—	—	—	—	—
12.	Khandiunsain	—	—	—	—	—	1	—	Khandiunsain	1
13.	Kot	—	—	—	—	—	—	—	—	—

APPENDIX X.7 : (*Contd.*)

1	2	3	4	5	6	7	8	9	10	11
14.	Kholchaunri	—	—	—	1	Kholchanuri	—	—	—	1
15.	Lwali	1	Lwali	—	—	—	—	—	—	1
16.	Adhwani	—	—	—	—	—	—	—	—	—
17.	Khaljikhal	—	—	1	—	Khaljikhal	—	—	—	1
18.	Saknikhet	—	—	1	—	Saknikhet	—	—	—	1
19.	Banghat	—	—	1	—	Banghat	—	—	—	1
20.	Satpuli	1*	Satpuli	—	—	—	—	—	—	—
21.	Kandarpani	—	—	—	—	—	1	—	Kandarpani	1
22.	Mawadhar	1*	Mawadhar	—	—	—	—	—	—	—
23.	Patisain	—	—	—	—	—	—	—	—	—
24	Mundneshwar	—	—	1	—	Mundneshwar	—	—	—	1
25.	Pipalpani	—	—	—	1	Pipalpani	—	—	—	1
26.	Jakheti	1**	Jakheti	—	—	—	—	—	—	—
27.	Agrora	—	—	—	—	—	—	—	—	—
28.	Paidul	—	—	1	—	Paidul	—	—	—	1
29.	Parsundakhal	—	—	1	—	Paidul	—	—	—	1
30.	Kandara	—	—	—	—	—	—	—	—	—
31.	Bubakhal	—	—	—	—	—	—	—	—	—

32.	Daduadevi	—	—	—	—	—	1	—	Daduadevi	1
33.	Pauri	1	Pauri	1	—	Pauri	1	—	257 (Pokhri)	3
34.	Kyark	—	—	1	—	Kyark	—	—	—	1
35.	Kirtinagar	—	—	—	1	Kirtinagar	—	—	—	1
36.	Srinagar	—	—	—	—	—	1	—	Srinagar	1
37.	Sumari	—	—	—	—	—	1	—	Sumari	1
38.	Chaubatiakhal	—	—	—	1	Chaubatiakhal	—	—	—	1
39.	Choprium	—	—	1	—	Choprium	—	—	—	1
40.	Bhainswara	—	—	—	—	—	—	—	—	—
41.	Sikukhal	1	Sikukhal	—	—	—	—	—	—	1
42.	Pokhrikhet	1	Pokhrikhet	—	—	—	—	—	—	1
43.	Champeshwar	—	—	—	—	—	1	—	Champeshwar	1
44.	Pabau	—	—	—	—	—	—	—	—	—
45.	Khirsu	—	—	—	—	—	—	1	1214 (Mathigaon)	1
46.	Bhattisera	1	Bhattisera	—	—	—	—	—	—	1
47.	Kherakhal	—	—	1	—	—	—	—	—	1
48.	Mailisain	—	—	—	—	—	—	—	—	—
49	Chifalghat	—	—	—	1	Chifalghat	—	—	—	1
50.	Sankarsain	—	—	—	—	—	—	—	—	—
51.	Cholusain	—	—	—	—	—	—	—	—	—

APPENDIX X.7 : (*Contd.*)

1	2		4	5	6	7	8	9	10	11
52	Bajwar	—	—	—	—	—	—	—	—	—
53.	Damdeval	1	Damdeval	—	—	—	—	—	—	1
54.	Chaunrikhal	—	—	—	—	—	1	—	Chaunrikhal	1
55.	Pokhri	—	—	—	—	—	—	—	—	1
56.	Bhira	—	—	—	1	Bhira	—	—	—	—
57.	Thailisain	1*	—	—	—	—	—	—	—	—
58.	Nautha	—	—	—	—	—	1	—	Nautha	1
59.	Chakisain	1	—	—	—	—	—	—	—	1
60.	Paithani	—	—	1	—	Paithani	—	—	—	1
61.	Barsuri	—	—	2	—	Barsuri	—	—	—	2
62.	Rudraprayag	—	—	—	—	—	—	—	—	—
63	Khankara	—	—	—	—	—	—	—	—	—
64.	Sumerpur	—	—	—	—	—	—	—	—	—
65.	Ratura	—	—	1	—	Ratura	—	—	—	1
66.	Molkakhal	—	—	—	—	—	—	—	—	—
67.	Gidokhal	—	—	—	—	—	—	—	—	—
68.	Chaunra	—	—	—	—	—	—	—	—	—
69.	Gadoli	—	—	1	—	Gadoli	—	—	—	1
70.	Tarpali	—	—	—	—	—	—	—	—	—
71.	Bungidhar	—	—	—	1	Bungidhar	—	—	—	1
72.	Samoya	—	—	—	—	—	1	—	2378 (Muniyagaon)	1
	Total	**14**	—	**19**	**7**	—	**10**	**1**	—	**45**

* High Schools to be upgraded to Inter College by 1979

** High Schools to be upgraded to Inter College by 1984

Out of the existing 14 high schools 2 *i.e.*, at Satpuli and Damdeval are located outside the Pauri Tehsil.

APPENDIX X 8 : PAURI TEHSIL : EXISTING AND PROPOSED JUNIOR COLLEGES

S. No.	Location	No.	Proposed for 1974-79					Proposed for 1979-1984				
				Location	Upgrading from Junior High School	Upgrading from High School	New construction		Location	Upgrading from Junior High School	Upgrading from High School	New cotruction
1.	Bahbazar	1	1.	Satpuli	—	1	—	1.	Dhelchaunri	—	1	—
2.	Kanskhet	1	2.	Thailisain	—	1	—	2	Sankarsain	1	—	—
3.	Kot	1	3.	Patisain	1	—	—		—	—	—	—
4.	Kandara	1	4.	Molkakhal	1	—	—	3	Bungidhar	1	—	—
5.	Pauri	2	5.	Ghaunra	—	—	1	4.	Jakheti	—	1	—
6.	Srinagar	2	6.	Nahsain	—	1	—					
7.	Pabau	1										
8.	Khirsu	1										
9.	Kherakhal	1										
10.	Rudraprayag	1										
	Total	**12**			**2**	**3**	**1**			**2**	**2**	—

APPENDIX X.9 : PAURI TEHSIL : EXISTING AND PROPOSED HEALTH SUB-CENTRES

S. No.	Name of the Cluster	Existing (1973)		1974-79			1979-84			Total by 1984
		No.	Location	Name of the Cluster	New Construction	Location	Name of the Cluster	Upgrading	Location	
1.	Ghandiyal	1	Banekh	1. Bubakhal	1	Bubakhal	Ghindwara	1	Ghindwara	
2.	Lwali	1	Lwali	2. Bhattisera	1	Bhattisera	Jamlakhal	1	Jamlakhal	
3.	Kaljikhal	1	Kaljikhal	3. Molkakhal	1	Molkakhal	Nautha	1	Nautha	
4.	Agrora	1	Agrora	4. Gadoli	1	Gadoli	Bungidhar	1	Bundighar	
5.	Pauri	1	Srikot							
6.	Kyark	1	Chardhar							
7.	Chaubatiakhal	1	Devalgarh							
8.	Pabau	1	Pabau							
9.	Khirsu	1	Khirsu							
10	Ratura	1	Ratura							
	Total	**10**			**4**			**4**		**18**

Appendix X 10 : Pauri Tehsil : Existing and Proposed Maternity and Child Health Centres

S. No.	Name of Cluster	Existing		1974-79		1979-84		Total by 1984
		No.	Location	No.	Location	No.	Location	
1	2	3	4	5	6	7	8	9
1.	Bahbazar	—	—	1	Bahbazar	—	—	1
2.	Ghindwara	—	—	—	—	1	Bajan	1
3.	Baganikhal	1	Tairi	—	—	1	Baganikhal	2
4.	Diusi	—	—	1	Diusi	—	—	—
5.	Ghandiyal	—	—	1	Ghandiyal	—	—	1
6.	Kanskhet	—	—	1	Kanskhet	—	—	1
7.	Nahsain	—	—	1	Nahsain	—	—	1
8.	Safdarkhal	1	Safdarkhal	—	—	—	—	1
9.	Kamalpur	—	—	1	Kamalpur	—	—	1
10.	Jamlakhal	—	—	—	—	—	—	—
11.	Delchaunri	2	Delchaunri	—	—	—	—	2
12.	Khandiunsain	—	—	1	Khandiunsain	—	—	1
13.	Kot	1	Kot	—	—	—	—	1
14.	Kholchaunri	—	—	1	Kholchaunri	—	—	1
15.	Lwali	—	—	—	—		—	—

APPENDIX X.10 : (*Contd*)

1	2	3	4	5	6	7	8	9
16.	Adhwani	—	—	1	Adhwani	—	—	1
17.	Kaljikhal	—	—	—	—	—	—	—
18.	Saknikhet	—	—	1	Saknikhet	—	—	1
19.	Banghat	—	—	1	Banghat	—	—	1
20.	Satpuli	—	—	1	Satpuli	—	—	1
21.	Kandarpani	—	—	1	Kandarpani	—	—	1
22.	Mawadhar	—	—	1	Mawadhar	—	—	1
23.	Patisain	—	—	1	Patisain	—	—	1
24.	Mundneshwar	—	—	1	Mundneshwar	—	—	1
25.	Pipalpani	—	—	1	Pipalpani	—	—	1
26.	Jakheti	—	—	1	Jakheti	—	—	1
27.	Agrora	—	—	—	—	—	—	—
28.	Paidul	—	—	1	Paidul	—	—	1
29.	Parsundakhal	1	Parsundakhal	—	—	—	—	1
30.	Kandara	—	—	1	Kandara	—	—	1
31.	Bubakhal	—	—	—	—	—	—	—
32.	Daduadevi	—	—	1	Daduadevi	—	—	1
33.	Pauri		Pauri	—	—	1	Koti	2

34.	Kyark	—	—	—	—	1	Kyark	1
35.	Kirtinagar	—	—	1	Kirtinagar	—	—	1
36.	Srinagar	1	Srinagar	—	—	1	Chairgaon	2
37.	Sumari	—	—	1	Sumari	—	—	1
38.	Chaubatiakhal	—	—	—	—	1	Chaubatiakhal	1
39.	Choprium	—	—	1	Choprium	—	—	1
40.	Bhainswara	—	—	1	Bhainswara	—	—	1
41.	Sikukhal	—	—	1	Sikukhal	—		1
42.	Pokhrikhet	—	Pokhrikhet	—	—	—	—	1
43.	Champeshwar	—	—	1	Champeshwar	—	—	1
44.	Pabau	1	Marora	—		—	—	1
45.	Khirsu	—		—	—	1	Mathigaon	1
46.	Bhattisera	—	—	—		—	—	—
47.	Kherakhal	1	Paurikhal	—		1	Kherakhal	2
48.	Mailisain	—	—	1	Mailisain	—	—	1
49.	Chifalghat	—	—	1	Chifalghat	—	—	1
50.	Sankarsain	—	—	1	Sankarsain	—	—	1
51.	Cholusain	—	—	1	Cholusain	—	—	1
52.	Bajwar	—	—	1	Bajwar	—	—	1
53.	Damdeval	1	Pinani		Damdeval	—	—	2

APPENDIX X.10 : (*Contd.*)

1	2	3	4	5	6	7	8	9
54.	Chaunrikhal	—	—	1	Chaunrikhal	—	—	1
55.	Pokhri	—	—	1	Pokhri	—	—	1
56.	Bhira	—	—	1	Bhira	—	—	1
57.	Thailisain	1	Thailisain	—	—	1	Rauali	2
58.	Nautha	—	—	—	—	—	—	—
59.	Chakisain	—	—	1	Chakisain	—	—	1
60.	Paithani	1	Paithani	—	—	—	—	1
61.	Barsuri	—	—	1	Barsuri	—	—	1
62.	Rudraprayag	1	Rudraprayag	—	—	—	Dungra	2
63.	Khankara	—	—	1	Khankara	—		1
64.	Sumerpur	—	—	1	Sumerpur	—		1
65.	Molkakhal	—	—	—	—	—	—	—
66.	Ratura	—	—	—	—	—	—	—
67.	Gidokhal	—	—	1	Gidokhal	1	Khand Talla	2
68.	Chaunra	—	—	1	Chaunra	—	—	1
69.	Gadoli	—	—	—	—	—	—	—
70.	Tarpali	—	—	1	Tarpali	—	—	1
71.	Bungidhar	2	Bungidhar, Bajoti	—	—	—	—	2
72.	Samoya	—	—	1	Samoya	—	—	1
	Total	17		44		11		72

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